· ENGINEERING NEWS-RECORD ·
NOVEMBER 3, 1938

THE WEEK'S EVENTS

Utilities Agree To Expand

National Defense Power Committee announces commitments to buy 1,000,000 kw. of equipment

Definite commitments on the part of fourteen utility companies in strategic war material centers to place immediate orders for turbine generators and auxiliary equipment amounting to 1,000,000 kw. of generating capacity were announced Oct. 28 by the National Defense Power Committee. War material producing areas which would be affected by the agreement include Baltimore, Birmingham, Boston, Bridgeport, Buffalo, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Pittsburgh, Rochester, St. Louis and Schenectady.

Spend two billion

The immediate effect of the program, according to Floyd L. Carlisle of the Consolidated Edison Company of New York, will be the placing of orders for about $350,000,000 worth of equipment. Within the next two years, the total amount of the companies' outlay will approach $2,000,000,000.

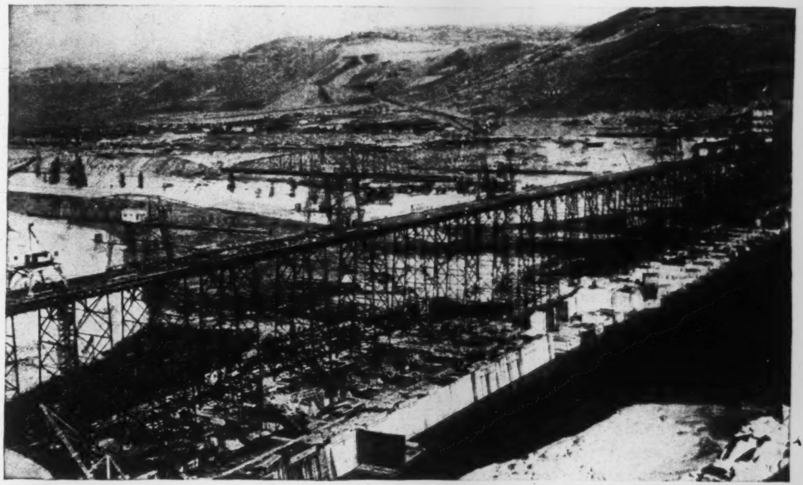
No question of outright grants by the federal government is involved in the agreement.

"It is understood." the committee said, "that statutes already in effect would permit government agencies to give assistance, if necessary, in financing the national defense program for electric power expansion in appropriate cases."

Replace old plants

New private plants, when constructed, will be operated as a part of the companies' systems, replacing older and less efficient plants, which will be held for reserves and emergencies.

The committee, which was created by the President last September to study problems of electric power as related to the national defense, also announced that conferences are being arranged with electrical equipment manufacturers to standardize equipment so as to expedite production, reduce costs, and prevent runaway prices.



Bureau of Reclamation photo

HIGH TRESTLE COMPLETED AT GRAND COULEE

COMPLETION of the trestle which spans the finished low dam at Grand Coulee, opens the way to get concreting fully under way on the high dam structure. Hammerhead and whirley cranes balanced on the trestle will lower buckets of concrete brought along the trestle by small locomotives. A similar trestle at a lower level was used to construct the low dam.

State May Reject Bids Of "Unfair" Contractors

The Montana State Board of Education may legally reject a low bid offered by a contractor likely to have labor difficulties, State Attorney-General H. J. Frebourn has ruled. The regional office of PWA had requested an opinion as to whether the board's action in rejecting the bid of a Missoula electrical contractor who had been placed on the unfair list of the electricians union complied with the law requiring award of the contract to the lowest responsible bidder.

Freebourn said that labor difficulties would affect the bidder's responsibility and that "if it is known that a bidder, on account of his attitude toward labor, will likely have labor troubles on the project, which may result in delay, additional expense or other inconvenience, it is my opinion that the board is not required by statute to accept his bid."

The contract in question covered electrical work on a $50,000 extension of the Natural Science Building at the University of Montana in Missoula. Bids were opened Sept. 12.

First Contract Is Let On South Penn Highway

The first contract on the $60,000,000 South Penn highway project has been let, covering construction of 10 miles of roadway. This portion of the Harrisburg-Pittsburgh superhighway was awarded to L. M. Hutchinson of Mount Union, low bidder at $458,000. Twenty-seven bids were received by the Pennsylvania Turnpike Commission for this section of the project.

The commission has announced that it has purchased the right-of-way of the old South Penn R. R., along which the new highway is being built, from its owners, the Pennsylvania and the Baltimore & Ohio railroads, for $2,000,000. Also announced was a proposed schedule of tolls: $1.50 for passenger cars and light trucks, $4 for buses, and $2 to $10 for heavy trucks.

The superhighway is being financed by means of a PWA grant of $24,000,000 and the sale to RFC of $35,000,000 in bonds to be retired from toll charges. RFC has already sold a block of $10,000,000 of the bonds to a New York bonding firm.

County Rejects Plan For Fire Island

Moses' proposal for parkway along Long Island barrier beach turned down

Suffolk County supervisors on Oct. 31 rejected a plan for the restoration of Fire Island which had been proposed to it by Long Island State Park Commissioner Robert Moses and somewhat modified by W. Earl Andrews, consultant to the Board of Supervisors. Fire Island, a long barrier beach on the ocean side of Long Island, was seriously damaged in last month's hurricane, many of the sand dunes being swept away and inlets being cut completely through the island at several points.

Forty-three mile parkway

The Moses plan, estimated to cost $15,500,000 (*ENR* Oct. 13, 1938, advertising p. 28) called for dredging of a boat channel through the bay inside Fire Island, use of the spoil to build up the dunes and fill in the inlets on the island, and binding down of the fill by construction of a 43-mile two-lane parkway along the island. It also called for construction of two connecting bridges and a 4½ mile road on Long Island proper to connect the new parkway with the Montauk Highway. Andrews had made some changes and simplifications, reducing the estimated cost to $9,250,000.

Instead of adopting the Moses plan, the supervisors appropriated $50,000 for restoration of the beach through the construction of wire fence and brush jetties and another $50,000 for filling in three inlets.

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Civil Engineers Name New Honorary Members

Five engineers have been named to honorary membership in the American Society of Civil Engineers. The men so honored are Frank E. Weymouth, general manager and chief engineer, Metropolitan Water District of Southern California; Edward E. Wall, director of public utilities, St. Louis; Anson Marston, dean emeritus, school of engineering, Iowa State College; C. Frank Allen, professor emeritus, Massachusetts Institute of Technology; Arthur S. Tuttle, consulting engineer, New York.

Formal conferring of honorary membership on these men will take place at the annual meeting of the American Society of Civil Engineers in New York on Jan. 18.

Fairchild Aerial Surveys

NO ROAD HERE

HURRICANE damage to Fire Island—sweeping away of dunes and creation of inlets—is visible in the airview above. As stated in the adjoining column, the supervisors of Suffolk County have turned down a proposal to build a parkway to protect this exposed location.

Southern Pacific Repairs March Flood Damage

The Southern Pacific R.R. has announced completion of the reconstruction of its properties damaged in the March, 1938, floods in Southern California at a total cost of $2,138,000. Largest single item was relocation of more than four miles of its Los Angeles to San Francisco main line in Soledad Canyon; tracks were raised in some instances as much as 17 ft., and ten crossings of the Santa Clara River were eliminated.

Another major replacement was the bridge over the Los Angeles River near Dayton Ave., completely destroyed in the flood. The structure is a through girder bridge with girders 385 ft. long and 12 ft. deep. It crosses the new channel constructed by the U. S. Army Engineers in a single span.

Because of the depth of bed-rock, the concrete piers of a new bridge at Alhambra Ave. rest upon a foundation of unique piles, each consisting of three scrap rails welded together at the railheads, the webs radiating from the center, and the bases outside.

To replace a 620-ft. trestle over the Santa Ana River at Colton, a complete new deck was built on car trucks mounted on rails in the streambed. When completed, the deck was rolled into its place on new pile bents that had been driven simultaneously. The new deck was ready for service four hours after the start of the operation.

Canadians Prefer Activated Sludge

Forty per cent of Canadian sewage plants use activated-sludge treatment, Canadian Institute hears

Of the 120 communities in Canada having sewage treatment plants, 47, or 39.2 per cent, have plants of the activated-sludge type, W. L. Malcom of Cornell University told the Canadian Institute on Sewage and Sanitation, meeting in annual convention at Toronto Oct. 20-21. This compares with a percentage of only 2.8 per cent in the United States, where out of 3,697 sewage plants, 102 are of the activated-sludge type.

Treatment in Canada

A somewhat higher percentage of Canadian communities than of American have some type of sewage treatment, Malcom told the convention: of 415 communities in Canada with a population of more than 1,000, 120 have plants, while of 16,280 such communities in the United States, 3,697 treat their sewage.

W. C. Miller, city engineer of St. Thomas, analyzed the financing of municipal work. He suggested that centrally located office and business buildings are overtaxed in comparison with the average residential and industrial property in city areas.

Miller elected

The design of storm sewers was discussed by W. B. Redfern of Toronto, and a final group of papers treated the subject of refuse incineration.

At the final session, W. C. Miller was elected president.

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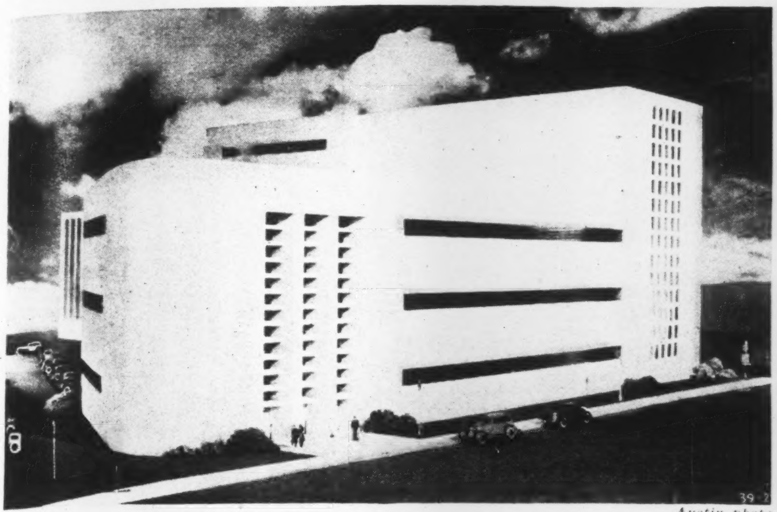
Vermont Not to Oppose Federal Flood Control

Governor Aiken of Vermont has offered to contract with the War Department for acquisition and eventual transfer to the federal government of land required for construction of flood control dams at Union Village on the Connecticut River. The Union Village project is one of those on which work is to be got under way in the near future with PWA, WPA, and army funds. (*ENR* Oct. 20, 1938, p. 481).

A Vermont statute provides that the state public works board may acquire title to land and easements without the consent of the governor and may then convey them to the United States under the Flood Control Act. The governor has ordered the board to proceed with such a move.



Austin photo

WORK STARTS ON WINDOWLESS FACTORY

CONSTRUCTION began early this month on a windowless, air-conditioned plant being built by The Austin Co. at Syracuse for Church & Dwight Co. Six to eight stories high, the $2,500,000 building will be of all welded steel construction with brick walls in which bands and slotted panels consisting of glass blocks will be framed by a trimming of limestone.

Cover to Be Constructed For Milwaukee Reservoir

Further to guarantee the purity of Milwaukee's water supply, the common council has voted to cover the Kilbourn park reservoir with a concrete cover to cost $325,000. Henry Bohmann, superintendent of the water department, urged immediate construction in view of the fact that the city's new filtration plant will be in operation soon and that it would be folly to purify water and then pump it into an open reservoir where it would be exposed to possible contamination.

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Washington Airport Put Under Construction

At the direction of President Roosevelt, construction has been started on a new airport for Washington, D.C., at Gravelly Point, on the south shore of the Potomac River near the George Washington Memorial Parkway. The present Washington-Hoover Airport has long been condemned as unsafe because of its limited size and nearby obstructions. Most of the new field, which will have an area of 750 acres, will be on made land built up by hydraulic dredging from the river bed. Its estimated cost is $10,000,000.

Governmental red tape was slashed to make possible an immediate start of construction. After years of disagreement on the part of Congressional committees as to the virtues of several potential sites, the President summarily directed the Civil Aeronautics Authority to start work at the Gravelly Point site, and an Army dredge was borrowed to get the project started.

Financing the work is yet to be taken care of, but CAA has an application in for PWA funds and it is anticipated that some labor will be provided by WPA. The law creating the CAA forbids that body to acquire airports by purchase or condemnation, but does not prohibit their construction.

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South Carolina Court Upholds Housing

Bringing to nine the number of state supreme courts which have approved state housing authority laws, the Supreme Court of South Carolina has held constitutional the South Carolina law. A taxpayers suit had sought to enjoin the housing authority of the city of Columbia from issuing bonds and acquiring property.

In a decision substantially paralleling that of other state high courts, the South Carolina court held that housing and slum clearance are public purposes and that the power of eminent domain may thus be conferred on housing authorities; that revenue bonds issued by housing authorities do not come within the municipal debt limit; and that property of the housing authority is tax-free and the city may make donations to the authority.

Large Savings Made On Queensbridge

Second New York project shows lower cost per room than Red Hook

When bids were opened by the New York City Housing Authority for construction of the Queensbridge low-rent housing project, it was discovered that, although the project contained 2,509 more rooms than were provided for in the original application to the U. S. Housing Authority, the final cost of the combined Red Hook-Queensbridge development will be about $6,333,000 less than was originally arranged for with USHA.

Final award of the construction contract has not yet been made, although a recommendation has been submitted to the U. S. Housing Authority for approval. New York Housing Commissioner Rheinstein announced, however, that prices indicate that the room cost for construction will be less than that at the Red Hook project in Brooklyn.

The Queensbridge project, located in Long Island City just north of the Queensboro Bridge, includes 24 dwelling structures, containing 12,967 rooms, in addition to a community building and a nursery school; the project covers about 40 acres of ground.

Other USHA activities

During the past week, the U. S. Housing Administration approved construction bids for two projects in Austin, Texas, the general construction contract on both going to Vincent Salbo & Sons, of San Antonio; executed an agreement to lease Meeting Street Manor and Cooper River Court, PWA housing projects in Charleston, to the Charleston Housing Authority at a monthly rental of $822; was notified that the Utica, N. Y. Housing Authority will advertise for bids about Nov. 14 on construction of a 213-unit $1,000,000 project in Utica.

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Detroit Not to Vote On Vehicle Subways

The Common Council of Detroit on Oct. 25 voted to remove from the ballot a proposal which calls for an advisory vote on a proposed $40,000,000 vehicle tunnel (*ENR*, Oct. 20, 1938, p. 480).

The proposition was removed at the suggestion of Commissioner of Public Works Henry E. Beyster, a proponent of the plan. Beyster feared that the vote might prove detrimental to consideration of a rapid transit subway project now before PWA.

PWA Has Alloted Nearly All Money

On Oct. 29 more than $900,000,000 had been allotted in grants and loans

With the approval of 521 non-federal projects involving a total construction cost of $86,713,840, the Public Works Administration on Oct. 29 virtually completed the first stage of its 1938 program. Allotments include 6,417 non-federal projects with a total estimated cost of $1,482,218,277 plus 1,052 federal projects for $195,499,704. The former involve loans of $48,753,013 and grants of $666,352,123. While there will be minor adjustments, recissions, and perhaps a few isolated new approvals in this program, these will affect the totals very slightly.

Work starts fast

Figures compiled as of Oct. 28 (before the final batch of allotments) indicate that remarkable speed has been made in getting under way the 1938 PWA program, which did not start until June 21. Of 5,896 projects, 15 had been completed, 2,114 were under construction, 57 more had been awarded, 56 advertised for bids, 2,110 were about to be advertised, and the remaining 1,438 were in various stages of negotiation between PWA and the sponsors. Under the provisions of the law all must be under construction by January 1, 1939.

While most of the final list of approvals were for relatively small projects, it included a few large allotments, among which were: $4,306,201 to the state of Michigan for a highway program; $5,324,471 for bridges in Pittsburgh, Pa.; $3,704,750 for a waterworks job in Bethlehem, Pa.; a $6,260,980 bridge and highway program in Connecticut and a $3,120,000 toll bridge at Jamestown, R. I.

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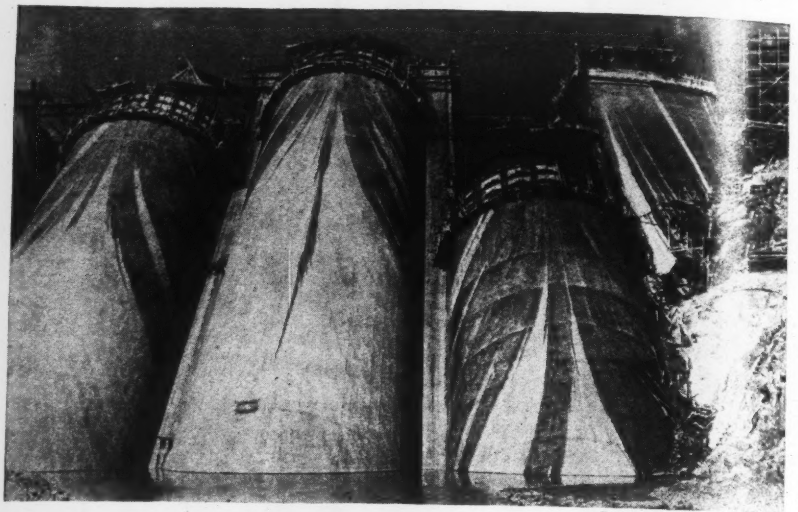

Bureau of Reclamation photo

ARCHES AT BARTLETT DAM

HIGHEST of its type in the world, Bartlett Dam on the Verde River in Arizona is approaching completion. The 270-ft. multiple-arch structure, which is being built by the Bureau of Reclamation, will store 200,000 acre-ft. of water to provide a supplementary irrigation water service at the Salt River project of the United States Bureau of Reclamation.

Arkansas County Judges Paid from Road Funds

County judges in Arkansas may legally receive part of their salaries, up to half, from the county road fund derived from a special road tax, the state supreme court decided on Oct. 24. The court decision reversed a decision of two years ago.

A 1929 act made county road judges ex-officio road commissioners, and the act was amended in 1933 to impose on county judges the duty of actual supervision of all roads in the county and to make the road fund liable for part of their salaries.

In 1936, in a divided decision, the state supreme court held that this amendment conflicted with a constitutional provision providing that the proceeds of the road tax be used exclusively for construction and maintenance of public roads and bridges. At that time the court held that apportionment of this fund to salaries or administration expenses is not a dedication to or use upon public roads or bridges. The present decision of the court reverses the 1936 interpretation.

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Riggs Denies Attacking General PWA Policy

The interview in which Henry E. Riggs delivered an attack on certain of the policies of the Public Works Administration (*ENR* Oct. 20, 1938, p. 480) was reported in the New York *Times* in a manner which "was seriously misleading and was made to give the wrong emphasis due to omissions," Riggs said in a letter to Arthur J. Bulger, director of the engineering division of PWA.

"I did not at this interview," Riggs wrote, "nor have I ever criticized the general policies of the Public Works Administration. . . . This agency has had my approval from the outset. . . . I said nothing in the Rochester interview which should have been capable of the construction placed upon it in the finally written draft. . . .

"I have criticized some of the early and very large projects. . . . The Missouri River navigation project, including Fort Peck Dam, and Grand Coulee appear to me to be just as un-sound economically and as little justified as the now abandoned Passamaquoddy project or the Florida Canal. . . . Relief money ought to be spent on work costing from a few thousand dollars to perhaps a maximum of five to ten millions. . . .

". . . I have never criticized the engineering design, construction methods or unit costs of any PWA or other federal work large or small . . .

"It is the economics of these large projects. . . that I can see as indicating possible failure and such matters that I criticize. . . .

". . . Any views I have expressed orally or in any public statements are my own personal views, not in any way endorsed by the society. . . ."

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Four States Vote On Tax Diversion

Voters in four states will pass this month on proposed constitutional amendments prohibiting use of highway funds for non-highway purposes. The states are Alabama, California, Michigan, and New Hampshire.

In California an initiative measure is to be voted on which calls for reorganization of the state highway commission and the state highway patrol. In Missouri, the ballot includes a proposed constitutional amendment setting up a ten-year highway plan and a referendum on a one-cent increase in the gasoline tax.

Darling Dies in St. Paul Pioneer Railway Man

William L. Darling, active for nearly 60 years in railway development in the Northwest, died in St. Paul Oct. 27 at the age of 82. Darling had practiced in St Paul as a consultant since his retirement in 1916 from the post of chief engineer of the Northern Pacific Ry.

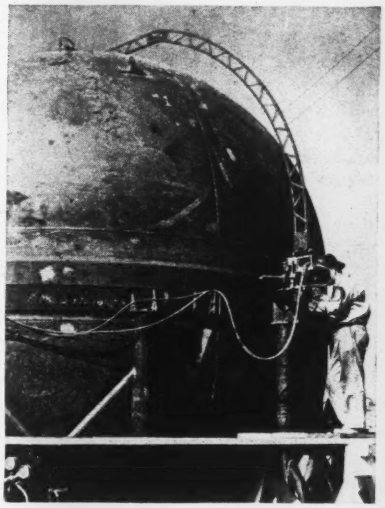
Darling first entered the railway field in 1879 and spent three years on the Northern Pacific staff. He then became resident engineer for the St. Paul & Northern Pacific and later locating engineer for the Chicago Burlington & Quincy and for the Florida Ry. In 1885 he was made engineer in charge of terminals of the Chicago Burlington & Northern, and in 1898 he became assistant chief engineer of the Northern Pacific system, which had absorbed several lines on which he had previously worked. Three years later he became chief engineer and, except for two years as chief engineer of the Rock Island system, held that position until 1916.

Thomas Heatley, who retired four years ago from a post as chief testing engineer for the Bureau of Buildings of the Borough of the Bronx, New York City, died at Lakewood, N. J., at the age of 73. Heatley had been a member of the state board of examiners of architects.

Theron A. Noble, 75, a Seattle civil engineer who had practiced there since 1893, died in that city Oct. 25. Noble studied at Iowa State College and the Massachusetts Institute of Technology, leaving the latter in 1886. At the turn of the century, he was chief engineer for the Seattle Power Co. He was also engineer on a number of irrigation dams and canals in Yakima.

Robert R. Crowell, civil engineer of Jamaica, L. I., died Oct. 27 in Jamaica at the age of 74. Crowell began his engineering career in 1896 as an assistant to the county engineer of Queens County, later worked for the bridge department of New York City and in 1903 held a post in the Queens topographical bureau where he remained until 1911, when he went into private practice.

John Goodell, of the Beardstown, Ill., firm of Godell & Millard, civil engineers, died Oct. 30 in Beardstown at the age of 63. Goodell was an engineer for many drainage districts in the Illinois valley. He was a graduate of the University of Illinois.



BULKHEADS AT GRAND COULEE

This is one of the spheres, 18 ft. in diameter, built up on the job at Grand Coulee Dam. After each sphere is completed and subjected to a test under internal hydrostatic pressure, it is cut in two on the "equator". Each half will serve as a temporary bulkhead in the upper end of the 18-ft. penstocks that pass through the dam.

Roy J. Blackburn, retired St. Louis contractor, died Oct. 27 at Daytona Beach, Fla., at the age of 56. He retired about seven years ago.

Elmer L. Kretzer, Sr., civil engineer for the East St. Louis Light & Power Co., died in St. Louis early this month at the age of 44.

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Lathing Contractors Indicted in New York

Twenty-eight lathing contractors and union officials operating in Brooklyn, N. Y., were indicted Oct. 25 by the Queens County Grand Jury on conspiracy charges. It is charged that the contractors bid collusively on lathing work in Brooklyn, agreeing in advance on which contractor would receive a particular job.

By introducing their relatives into Local 244 of the Wood, Wire and Metal Lathers International Union, the contractors were able to enforce their agreement. Thus, if an outside contractor bid low on a job, it is charged, the union would apply special job restrictions which would make it impossible to do the work at a profit.

The formal charges against the defendants are committing an act injurious to trade, cheating and defrauding other persons of property and money by criminal means, and preventing persons from exercising their lawful trades.

Federal Aid Urged For Airports

Conference of Mayors says airport traffic facilities are federal responsibility

Pointing out that a major part of the service rendered by municipal airports is for the benefit of interstate commerce and national defense, the U. S. Conference of Mayors has presented to the Civil Aeronautics Authority a proposal that the federal government assume responsibility for all air traffic facilities at major municipal airports.

The mayors' report was made at the request of the newly constituted authority. C.A.A. is required to transmit to Congress next February recommendations on whether the federal government should participate in the cost of a national system of airports and on the extent and nature of such participation.

Resemble waterways

In their report, the mayors assert that the airway system is analogous to navigable waterways and should be similarly financed. They point out that in the case of waterways, the federal government assumes responsibility not only for channels but also for navigation aids within harbors up to the very point where the ships are drawn up to the dock.

Likewise, they say, the federal government should provide all the air navigation aids used by an airplane until it comes to rest. Thus, just as the government now provides beacons and emergency landing fields along the airways, it should also provide runways and landing facilities at major municipal airports.

The mayors suggest a division of responsibility between the municipalities and nation on the basis that the city provide the land, all buildings required and the management of the airport. Federal responsibility would extend to runways, lights, and all communication and weather control facilities.

National airport system

The mayors emphasized that federal aid should not be "promiscuously allotted" but be restricted to air terminals forming an essential part of the civil transport system and essential to the national defense. They propose that the Civil Aeronautics Authority map out a national airport system in the same way that the federal aid highway system was established to provide orderly airway development.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

TOTAL EXPENDITURES of the federal government for the fiscal year which began July 1, through Oct. 24, amounted to $2,846,499,000. This was $396,546,000 more than was expended during the corresponding period of the preceding fiscal year. Efforts to force out money as a stimulant to business are beginning to take hold. The curve of expenditures is expected to rise rapidly from this time forward as PWA and armament projects get under way.

INSURMOUNTABLE obstacles stand in the way of PWA participation in the Battery-Brooklyn vehicle tunnel project in New York City, Secretary Ickes said Oct. 31. Ickes said he did not see how the project could be completed by July 1940, as required by law, and that in any case PWA did not have the money available.

CHARGING that his first application (*ENR*, Oct. 6, 1938, p. 419) for permission to build a new railway line between Harrisburg and Pittsburgh had been rejected because of "deliberate, false, vicious and criminal statements by representatives of the state of Pennsylvania" Roy Greene of Pittsburgh has filed a second application with the ICC. His proposed line would follow the route of the uncompleted South Penn Ry., along which the Pennsylvania Turnpike Commission is now beginning to build a toll superhighway.

COMPLETION of the 3,250-mile section of the Pan-American Highway between Laredo, Tex., and Panama City, Panama, would cost about $78,308,000, according to a report prepared by a committee on finance for submission to the governments of the nations concerned. The cost of the various sections would be as follows: Panama $12,283,000; Costa Rica $12,427,000; Nicaragua $8,418,000; Honduras $4,375,000; El Salvador $4,293,000; Guatamala $13,803,000; Mexico $22,709,000.

PLANS for the 1940 decennial census include more attention to so-called metropolitan areas, on which the 1930 census obtained little more than bare population figures. It is now proposed to treat these regions in the same fashion as the smaller cities so as to secure other necessary data. In this connection the Census Bureau is considering the advisability of enlarging its definition of a metropolitan area. Present usage includes only townships having a population density of more than 150 per square mile surrounding one or more 50,000-population communities, the whole area inhabited by at least 100,000 persons.

CENSUS OFFICIALS predict a sharp falling off in number of annexations of one community by another during the 1930–1940 decennium as compared with the previous ten-year period. It is pointed out that when relief burdens are heavy the tendency is to avoid any move that would increase the load.

PERSONAL

W. B. BRANTLEY, who has been assistant chief engineer in the Georgia highway department, has been made chief engineer of the department.

EUGENE STANLEY, chief engineer of the Georgia highway department, has been made assistant chief engineer in charge of federal aid projects.

CHARLES M. LEEDY, formerly chief engineer for PWA in Colorado, has been made assistant regional PWA engineer with headquarters at Fort Worth.

CHARLES P. SMITH, for the past 4½ years resident engineer inspector at Houston for the U. S. Bureau of Public Roads, has resigned to enter private practice. His first undertaking is to supervise a $1,000,000 public improvement program at Orange, Texas, which includes sewer and sewage disposal and gas distribution systems and waterfront improvement.

H. V. ROBERTS, who has been in the Oklahoma City office of the U. S. Bureau of Public Roads, has been transferred to Houston as resident engineer and inspector there.

CARL T. HOLMER, city engineer of Ontario, Calif., has been made city manager there. Holmer has been in the employ of the city of Ontario for 15 years.

ROBERT C. CANNON, Harry J. Krug, and Nicholas A. Brennan have opened offices in Baltimore under the name of the Taylor Engineering Corp. to engage in a general engineering practice.

B. H. FRASCH, chief engineer of maintenance in the Ohio highway department, has resigned after eight years in the department. Political disagreement with Governor Davey was the reason for his resignation, Frasch said.

E. R. GRIFFIN, engineer of surveys and design in the North Dakota highway department, has resigned to take a post with PWA at Washington.

E. R. TUSKIND, office engineer in the North Dakota highway department, has been made engineer of surveys and design, succeeding E. R. Griffin.

MAX R. SHOSTACK, WPA area engineer at Council Bluffs, Iowa, has resigned to join the engineering division of PWA. He will be stationed at Council Bluffs.

WILLIAM A. ROSE has been appointed assistant professor of structural engineering at New York University. A graduate of the University of Minnesota and New York University, Rose has been for the past seven years assistant engineer in the office of the designing engineer of the New York Central R.R., working on the West Side improvement program in New York City and the Syracuse grade crossing elimination. Earlier he was in the office of A. Fraser Rose, consulting engineer of Miami and New York.

F. H. WHITLEY, instructor in civil engineering in South Dakota State College, has been appointed instructor in sanitary engineering at New York University. After his graduation from North Carolina State College, Whitley was for several years research assistant at the University of Illinois. He worked for a year as a staff engineer for Charles DeLeuw & Co. of Chicago, and went to South Dakota last year.

LIEUT. WM. B. HOWARD of the Navy Civil Engineer Corps has been transferred from the San Diego naval base and made public works officer at the naval station in Tutuila, Samoa. He will take up his new station in December or January.

ROY M. HENDERSON has been elected vice president of United Engineers & Constructors, Inc. of Philadelphia, with headquarters at Chicago. Henderson joined United Engineers in 1928 at the time of the merger with Dwight P. Robinson & Co. of New York, of which firm he was vice president. For several years thereafter he was president of the Canadian subsidiary with headquarters in Montreal.

D. H. MCDONALD has been appointed senior assistant engineer of the London, Ont., department of public works.

WILLIAM E. FOSS has retired from his position as director and chief engineer of the water division of the Metropolitan District Commission at Boston. Foss has served with the state since 1895 and for the past 23 years he has been chief engineer of the division and its predecessor organization. He entered the employ of the Boston city engineering department in 1886 and was active in construction of the city's water supply until he went with the state. As announced in *ENR* Sept. 29, Foss is succeeded by Samuel E. Killam. Before next spring, Foss plans to establish a consulting practice in Boston.

F. R. Sweeny has resigned his position as city engineer of Anderson, S. C., to become an engineer for the South Carolina Public Service Authority.

A. Howard Patterson, engineer for Anderson County, has been made city engineer of Anderson, S. C. Patterson was at one time chief engineer of the South Carolina WPA.

James R. Estes, for six years assistant engineer for the city of Hattiesburg, Miss., was recently appointed city engineer.

Floyd E. Bates was recently appointed chief engineer of the Missouri Pacific line, filling a post which has been vacant since the death in 1932 of E. A. Hadley. Bates has been bridge engineer of the Missouri Pacific since 1923 and an employe of the road since 1913.

A. A. Miller is now chief engineer of maintenance of way and structures of the Missouri Pacific line. He has been with Missouri Pacific since the early part of 1909.

B. W. Klowden, engineer for the Sanitary District of Chicago on the construction of interceptors, recently became resident engineer of construction on the Front St. interceptor in Memphis, representing Black & Veatch, Kansas City consulting engineers. Klowden is a graduate of the University of Illinois.

Arthur V. Ruggles is now assistant hydraulic engineer in the water bureau of the New York State Public Service Commission. Ruggles was formerly with the New York City Board of Water Supply on the design of the Delaware Aqueduct and earlier worked with the American Water Works Association.

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Los Angeles Water Board Asked to Call for Bids

The Southern California Chapter of the Associated General Contractors of America has urged the Board of Water and Power Commissioners of Los Angeles to call for competitive bids, rather than use day labor, on three large projects which it is about to undertake: a $4,700,000 Mono Basin project; a $5,500,000 waterworks improvement; and a $13,000,000 power line to Boulder Dam. In addition, the contractors ask that the board "specifically and publicly" declare its policy regarding all competitive bidding on construction work.

In their communication, the contractors assert that award of contract by competitive bidding would effect considerable saving over day labor. They say that on a part of the Mono Basin project constructed by day labor the final cost was $18,250,000, although the original estimate had been $8,250,000, and they contend that this extra amount could have been avoided by competitive bidding.

Aqueduct Water May Be Treated

Metropolitan water district is preparing plans to filter and soften Colorado aqueduct water

The board of the Metropolitan Water District of Southern California has set under way preparation of plans and specifications for a softening and filtering plant for water delivered through the Colorado River aqueduct. Final decision concerning actual construction of the plant is to be made by the board within the next few months.

Under plans now being considered by the district, aqueduct water delivered to domestic and industrial consumers within the thirteen district cities will all be filtered and will be softened to a greater degree than much of the water now being served in these cities. None of the cities involved is now being served with filtered water.

The proposed treatment plant would be located on the Foothill Boulevard branch of the district's distribution system and water would be delivered from this point to each of the district cities.

• • •

Found: One Bridge

For the next six months the New York City police are the custodians of a 60-ft. ferry bridge of unknown ownership. The bridge, 60-ft. long, 40-ft. wide, and 12-ft. high, was found floating in the Hudson River Oct. 25, apparently having been in the water for some weeks. It is a single span structure such as is used for ferry slips along the river.

If not claimed by the owner after six months, the bridge will be sold at auction.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY ENGINEERING NEWS-RECORD, IN OCTOBER, 1938

Engineering News-Record *reports projects of the following minimum costs: Waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000.

Four Weeks—Thousands of Dollars (000 Omitted)

							United States			
								Ten Months		
	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	Oct. 1938	1938	1937	Canada
Public Works										
Waterworks	2,716	2,182	1,002	1,714	1,359	1,698	**10,671**	94,193	59,179	231
Sewerage	359	5,049	1,156	3,348	3,818	1,523	**15,253**	96,168	79,686	175
Bridges, public	1,727	1,944	1,304	1,685	770	533	**7,963**	88,500	106,658	160
Earthwork and waterways	3,767	2,348	4,730	583	7,042	6,958	**25,428**	232,755	90,626	2,560
Streets and roads	1,624	13,199	9,724	5,706	12,451	7,049	**49,753**	536,357	254,014	489
Buildings, public	4,277	22,413	6,719	8,052	8,013	6,505	**55,979**	334,845	267,072	2,706
Unclassified, public	145	5,226	1,334	1,224	811	4,085	**12,825**	157,499	120,831	663
Total public	**14,615**	**52,361**	**25,969**	**22,312**	**34,264**	**28,351**	**177,872**	**1,540,317**	**1,078,066**	**6,984**
Federal government (included in above classifications)	1,695	4,830	7,522	969	9,330	12,004	36,350	298,310	174,856	....
Private										
Bridges, private	....	....	....	....	....	....	....	5,551	7,145	....
Buildings, industrial	1,604	3,090	1,068	5,708	1,185	159	**12,814**	128,556	447,905	805
Buildings, commercial	600	23,029	760	2,510	6,762	1,552	**35,213**	486,371	398,340	1,200
Unclassified, private	....	3,624	551	1,620	3,435	769	**9,999**	74,863	141,553	1,172
Total private	**2,204**	**29,743**	**2,379**	**9,838**	**11,382**	**2,480**	**58,026**	**695,341**	**994,943**	**3,177**
Total Engineering Construction										
October, 1938 (4 weeks)	**16,819**	**82,104**	**28,348**	**32,150**	**45,646**	**30,831**	**235,898**	....	....	**10,161**
September, 1938 (5 weeks)	16,836	108,788	27,184	55,626	46,471	34,820	**289,725**	....	....	6,215
October, 1937 (4 weeks)	7,867	73,783	20,314	45,102	25,083	14,852	**187,001**	....	....	12,773
Ten Months — 1938	112,077	872,978	222,237	297,059	387,239	344,068	....	2,235,658	....	73,640
Ten Months — 1937	97,924	903,747	207,064	359,636	299,074	205,564	....	....	2,073,009	115,541

CONTRACTS AND CAPITAL

ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . FHA MORTGAGES

(,000 omitted)	October 1937 (4 wks.)	October 1938 (4 wks.)	% Change	Ten Months 1937 (43 wks.)	Ten Months 1938 (43 wks.)	% Change
Total Construction Volume	$187,001	$235,898	+26.0	$2,073,009	$2,235,658	+7.8
Private	100,519	58,026	−42.0	994,943	693,341	−30.0
Public	86,482	177,872	+106.0	1,078,066	1,540,317	+43.0
Federal	13,750	36,350	+164.0	174,856	298,310	+71.0
Total New Productive Capital	$58,617	$239,582	+308.0	$2,073,522	$3,352,450	+62.0
Private Investment	58,617	76,386	+30.0	919,234	849,557	−7.5
Federal (non-federal work)	....	158,669	....	408,065	1,359,248	+233.0
Federal (federal work)	....	4,527	....	746,223	1,143;645	+53.0
FHA Mortgages Selected for Appraisal	$44,866	$91,328*	+103.0	$519,826	$842,473*	+62.0

* *Preliminary.*

CONSTRUCTION COSTS . . . WAGE RATES . . . PRICES

	November 1937	November 1938	% Change	Changes October to November 1937 Oct.	1937 Nov.	%	1938 Oct.	1938 Nov.	%
ENR Construction Cost Index, 1913 = 100	241.40	234.40	−2.9	241.90	241.40	−0.2	234.30	234.40	+0.04
ENR Building Cost Index, 1913 = 100	200.30	195.58	−2.4	201.00	200.30	−0.3	195.48	195.58	+0.05

ENR 20-CITIES AVERAGE

	November 1937	November 1938	% Change	1937 Oct.	1937 Nov.	%	1938 Oct.	1938 Nov.	%
Common Labor	$0.678	$0.682	+0.6	$0.676	$0.678	+0.3	$0.682	$0.682	0
Skilled Labor (Av. 3 Trades)	1.382	1.427	+3.3	1.378	1.382	+0.3	1.427	1.427	0
Bricklayers	1.480	1.514	+2.3	1.467	1.480	+0.9	1.514	1.514	0
Structural Ironworkers	1.425	1.479	+3.8	1.425	1.425	0	1.479	1.479	0
Carpenters	1.242	1.288	+3.7	1.242	1.242	0	1.288	1.288	0
Cement, per bbl	$2.51	$2.57	+2.4	$2.53	$2.51	−0.8	$2.57	$2.57	0
Reinforcing Steel, cwt	2.91	2.48	−14.8	2.91	2.91	0	2.50	2.48	−0.8
Struct. Steel Shapes, Pitts.	2.25	2.10	−6.7	2.25	2.25	0	2.10	2.10	0
Lumber, 2 x 4 Fir, per M ft.	36.09	32.38	−10.3	37.02	36.09	−2.5	32.40	32.38	−0.1
Lumber, 2 x 4 Pine, per M ft.	31.88	28.59	−10.3	32.60	31.88	−2.2	28.39	28.59	+0.7
Brick, common, per M	14.12	13.87	−1.8	14.23	14.12	−0.8	13.81	13.87	+0.4
Ready-Mixed Concrete, c.y.	7.42	7.13	−3.9	7.42	7.42	0	7.12	7.13	+0.1
Struct. Clay Tile, 3 x 12 x 12	72.95	74.08	+1.6	72.85	72.95	+0.1	74.24	74.08	+0.2
Paving Asphalt, cars, ton	17.15	......	......	17.15	17.15	0	14.85	......	....

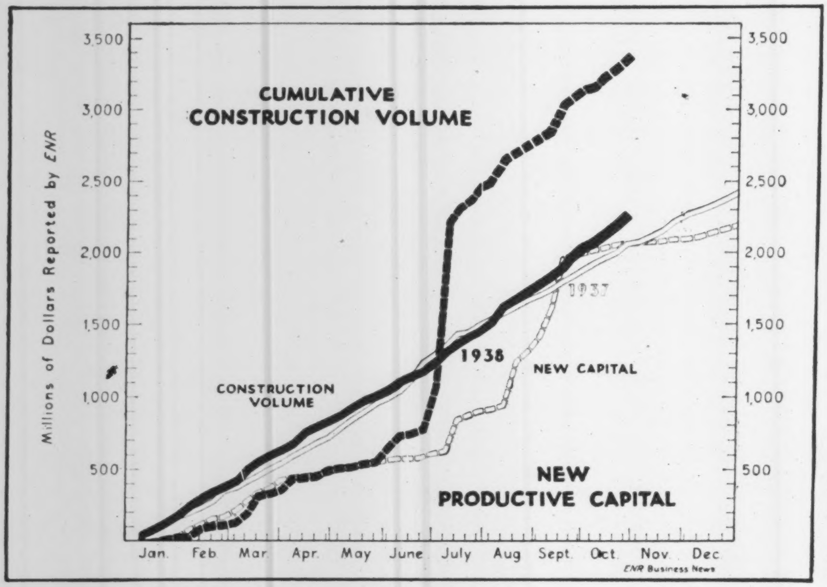
MATERIAL SHIPMENTS . . . BUILDING PERMITS

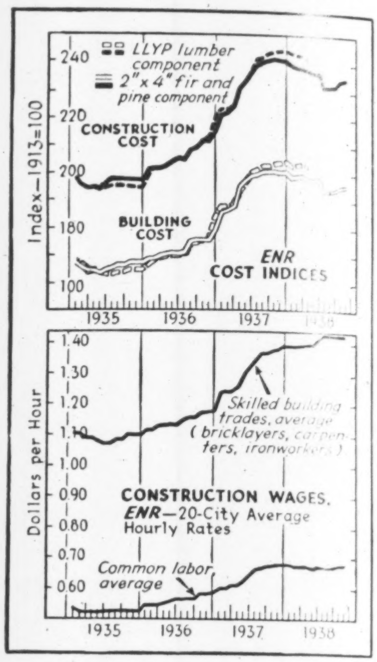
	October 1937	October 1938	% Change	Sept. 1938	% Change Sept.-Oct.
Lumber (% 1929 wk. av.) NLMA	63.0	65.5	+4.0	64.8	+1.1
Steel (% operating capacity), AISI	59.4	50.6	−14.8	44.6	+13.4

	September 1937	September 1938	% Change	Nine Months 1937	Nine Months 1938	% Change
Fabricated Struct. Steel (AISC) tons.	163,541	90,900	−44.4	1,266,095	831,345	−34.3
Cement, thous. bbl. (USBofM)	12,773	11,716	−8.3	89,839	79,288	−11.7
Building Permits, Dun & Bradstreet (000 omitted)	$86,769	$101,804	+17.3	$851,871	$871,192	+2.3

RENT INDEX . . . EMPLOYMENT

	September 1937	September 1938	% Change	Aug. 1938	% Change Aug.-Sept.
Rent (Housing) Index, NICB	88.6	86.6	−2.3	86.6	0
Trade Unions, % Employed, AFL	88.0	84.0	−4.5	83.0	+1.2
Building Trades, % Employed, AFL	77.0	67.0	−13.0	64.0	+4.7





THIS WEEK'S FIGURES

(Thousands of dollars)

CONTRACTS

	Week Ending Nov. 4 1937	Week Ending Oct. 27 1938	Week Ending Nov. 3 1938
Federal	$2,949	$5,282	$9,262
State & Municipal.	10,553	34,946	44,085
Total public	$13,502	$40,228	$53,347
Total private	8,925	13,406	17,666
TOTALS	$22,427	$53,634	$71,013

Cumulative
1938 (44 weeks) $2,306,671
1937 (44 weeks) $2,095,436

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 44 Kk.	Cumulative 1938 44 Wk.
NON-FEDERAL	$1,334,188	$2,268,109
State & Mun. bonds	436,590	532,233
Corporate securities	489,533	335,581
PWA loans, grants	178,126	808,236
RFC loans	29,939	100,128
U.S.H.A. loans	......	232,422
R.E.A. loans	......	58,009
Federal Aid-Highways	200,000	201,500
FEDERAL	$746,223	$1,143,645
TOTAL CAPITAL	$2,080,411	$3,411,754

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost '13	Building Cost '26	Volume '13	Volume '26
Nov. 1938	234.40	112.69	195.58	105.71		
Oct. 1938	234.30	112.63	195.48	105.67	217	95
Sept. 1938	232.70	111.86	194.80	105.30	213	93
Nov. 1937	241.40	115.80	200.30	108.35	148	65
Oct. 1937	241.90	116.10	201.00	108.70	167	73
1937 (Av.)	234.71	112.66	196.15	106.07	172	75
1936 (Av.)	206.42	99.15	172.18	93.14	185	81
1935 (Av.)	196.44	94.43	165.76	89.65	134	59

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Influence Lines

Sir: In your Oct. 6 issue, p. 443, an article by Prof. L. E. Grinter solves a problem in determining influence lines by balancing angle changes, and compares its convenience with some of the older methods of treating such problems.

He made no comparison with the method set forth on page 629 of the March, 1938, *Proceedings*, Am. Soc. C.E., which treats the angular changes in a continuous beam by a once-over direct solution instead of by a series of converging adjustments and which is believed by those of the writer's acquaintance, who have studied both methods, to be superior to the method used by Professor Grinter.

R. W. Stewart
Los Angeles, Calif.

Thank You!

Sir: I wish to compliment you on the concise and excellently reliable description you have given of the Greensboro, N. C., sewage disposal plant (*ENR* Sept. 15, 1938, p. 321). This article, in my opinion, is an outstanding example of how good plant descriptions should be written.

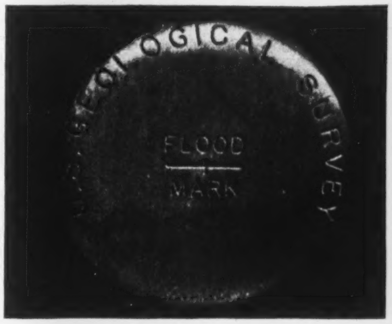
A. L. Genter,
Chem. & Mech. Eng., Baltimore, Md.

Sir: Our local newspaper, after having seen the article describing the new sewage disposal plant published a very favorable story together with comments on the editorial presented in the same issue. We are very grateful for the thorough manner in which the article was written and for the wonderful publicity which has been accorded to us as a result.

C. W. Smedberg,
City Manager, Greensboro, N. C.

High Water Markers

Sir: The use of high-water markers to keep alive an appreciation of flood dangers, as suggested in one of your editorials, is a good one. The accompanying illustration shows a bronze flood mark tablet which the Geological Survey devised soon after the March, 1936 flood, and which has been used quite extensively throughout New England.



Also, after the 1927 flood in New England, high-water markers were set at many points in Vermont by state officials in cooperation with the Survey. I agree with you that there should be a more systematic program for establishing high-water markers.

John C. Hoyt
U. S. Geological Survey, Washington, D. C.

Housing Costs

Sir: Referring to page 341 of your issue of September 22, you quote cost of $850 per room at Red Hook against $1,500 at Williamsburg, the public housing projects in New York City. Such wide difference suggests inquiry as to what is a "room". There must be an agreement as to what floor area or cube, constitutes a room, before statements for different buildings have informative value.

Persons having to deal with buildings use some measurement, such as cost per cubic foot, per square foot of floor; or, less generally, per room. There is no accepted agreement as to how these units are to be computed. Cubic foot computation is more nearly definite, but when you get to square feet of floor space there is wide variation. Some use square feet as the area within the walls of the building; others a summation of the square foot of the actual floor occupied by the separate apartment units and, in one extreme instance, a government publication computes floor square foot area, by adding the ceiling to the floor, as quoted on page 851 of your issue of December 19, 1935.

In office building practice, the net area inside partitions, is the floor space considered rentable. The federal government universally follows this principle in renting office space.

It would seem that a definite, utilizable, and fair basis of computing cost, would be to take a summation of the floor spaces of several apartment units, and use this divisor to obtain a square foot cost; and from that work out a room cost corresponding to the system adopted for that project. The reason for preferring the square foot as against cubic foot basis, is that there is no fixed relation between the amount of net floor space and the cube of the building.

When we speak of the cost of a building, we should honestly mean the total cost of the project as a going concern. An individual, if he remained solvent, would be compelled to estimate the following cost: (1) The pro rata of general and office expense applicable to the particular building; (2) Financing, and carrying charges to the time when the building was filled to the point where revenues, actual or computed, exceeded expenditures, the main items being taxes and interest; (3) Cost of the ground; (4) Cost of the building itself.

On statements made for government projects I have the impression that costs (1) and (2) are ignored. Undoubtedly a government bureau has large expenses for personnel and occupies space which has a theoretical rental value, the total annual charge of these items to the bureau can certainly be computed and a pro rata made from it to an individual project. As to (2), an interest charge corresponding to a general average paid on government securities should be stated. And as to taxes, a statement should be made, either that no tax is computed or a tax similar to what an individual would have to pay is included.

Government statements inevitably come into comparison with private experience, and if a cost is stated *all* the elements of private cost should be covered either by figures listed, or by specific statement that they are not listed, if there be omission of definite figures.

Riker Realty Co.
Washington, D. C.

ENGINEERING NEWS-RECORD
Copyright 1938, by McGraw-Hill Publishing Company, Inc.
Volume 121, Number 18
Editor, F. E. SCHMITT • *Editorial Staff*, V. T. BOUGHTON
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Editorial Offices at 330 West 42nd Street, New York
NOVEMBER 3, 1938

BY DRAWING AN ANALOGY between harbors and airports, the U. S. Conference of Mayors presents a good case to the Civil Aeronautics Authority on federal-aid for the ailing municipal airport. If the federal government, for example, pays for dredging channels in harbors and for providing them with traffic lights to serve shipping, it should pay for comparable facilities to serve airplane traffic, is the contention. The mayors' attitude on the airport question contrasts sharply with their attitude on some other questions, notably federal aid for city public works. In the latter case they have begged Uncle Sam to pay their own bills for them. But in discussing airports, they accept their responsibility for land, buildings and operating costs and urge on the federal government only those costs which their reasoning indicates are justified. Such an approach should be of distinct help to the CAA in its difficult job of formulating a national aeronautics policy.

The Independent Practitioner

ARCHITECTS in convention last week complained bitterly of government competition with independent practitioners, as a force tending to destroy the profession. Their attitude is significant in more ways than one. What has been going on in architectural design during the last few years, when much of the building that came under government control was handled by employed staff organizations, is paralleled by changes that went on in the civil engineering field beginning three or four decades ago. Before the turn of the century the independent practitioner was a large figure in civil engineering; then, however, industrial and utility corporations on the one hand and governmental units on the other set up permanent staffs of employees to carry out their engineering work, and today the private practice of engineering is of greatly reduced importance. Question has often been raised by engineers whether the highest type of creative work can be accomplished under civil service conditions. One answer is found in the fact that major project plans and special problems are commonly referred to boards made up of independent practitioners even though the staff organization is of recognized competence. The same question is now being asked by architects; perhaps a similar answer will develop. Meantime there is much justice in the architects' assertion that the government's failure to make fuller use of existing architectural offices in carrying on its emergency building programs has tended to retard the recovery that was aimed at.

Water Uncontrolled

DRAMATIC POSSIBILITIES lie in the struggle for water that is in progress along our Mexican boundary, as sketched by W. W. DeBerard in this issue. A great agricultural province depends for its survival on the dry-season flow of the Rio Grande, and if only a short cycle of drought years should come it would face destruction. Among the elements of the case are overdevelopment of land, conflict of riparian and appropriation claims to the river's water, inaction of the state in administering the water used by its citizens, and failure of the federal government to control the use of a stream governed by international obligations. Back of all is a serious lack of knowledge of the sources and variation of flow, a lack that only recently has been remedied in part by painstaking water surveys. No more striking lesson of the need for study and control of water resources can be found in American river experience, for, though the Rio Grande problem has become one of critical urgency, a solution is not yet in sight. One first step would be adjudication of present water claims on the American side of the river. Such determination of priorities would clear away much of the confusion that now beclouds the water problem of the Rio Grande.

Glue in Construction

RIDING a self-induced wave of research, timber structure design has made such substantial advances in the past few years that no one can remain unimpressed by them. New structures and detail improvements may however escape general notice in the boom period of development now under way. A school auditorium described in this issue, for example, marks a step toward the much-talked-of prefabricated house. Basically its significance lies in its use of glue instead of nails and bolts. Glued plywood, of course, is not a new material, but until recently glues for permanent outdoor exposure were not available. Even yet they are in the developmental stage, but research on synthetic resin glues is said to hold forth excellent prospects of success for the permanent construction required for building walls. It is important to watch the development of glue. It is rapidly becoming a construction material. When a truly water resistant, permanently waterproof glue is developed, one of the last obstacles to the complete prefabricated timber building will be removed.

Profitable Reading

THE CONTRACTOR'S INTERESTS are better protected in public-works construction than he commonly believes. Court decisions generally have clearly favored the contractor when he has presented a legally precise bill of claims. This the contractor frequently fails to do and because of his negligence often suffers losses that he might easily avoid. Excellent legal advice on the action to be taken is given in a series of articles, three of which have now been published, with the fourth to come soon. In turn these articles cover action in the case of claims for extras (*ENR*, April 8, 1937) delays and interference (*ENR*, Nov. 4, 1937), changed conditions, in this issue, and final settlements, to be published at a later date. Any contractor can spend an hour profitably in reading the simple directions given in these articles.

Professional Work Defined

JUST BEFORE the federal fair labor standards act went into effect last week, Administrator Elmer F. Andrews, himself an engineer by training, issued a definition of what constitutes professional work under the act which should be of wide interest to the engineering profession even though its direct effect on engineers at the present time will not be widespread.

Application of the labor standards act is limited to companies whose business is of an interstate character, hence practically all engineers on construction operations are unaffected. Engineers employed by electric utilities, by large manufacturing plants and by the producers of construction materials come under the act. Whether those employed by the large steel fabricators come under the exemption for construction operations is open to question. However, as Administrator Andrews favors amplification of the federal act through adoption of supplemental state acts, all the present exemptions may soon disappear, just as they are disappearing under state acts supplementing the Wagner labor relations act.

Few if any engineers or engineering employees will be affected by the minimum wage standard of 25c. an hour, but the working time limit which requires the payment of time and one half for overtime in excess of 44 hours a week, regardless of pay considerations, ultimately may have wide application, as it is through overtime work that engineers are most widely exploited.

Mr. Andrews' definition of professional work under the new act was given in our news pages last week. It is significant in that it helps to clarify the question of what constitutes professional work, a question that was raised soon after passage of the Wagner labor relations act and which comes up for discussion periodically. As now interpreted the act sets off to the professional class only those whose training and ability is such that they can demand adequate compensation and need no protection as to minimum wages or maximum hours. On the other hand, because it does set off only a small group, this interpretation stops any attempt by unscrupulous employers to push the professional classification so far down as to include a class of men who should have the protection of the fair-standards act or the labor-relations act, but who would be excluded from its protection were they to be classified as professional.

The new definition ultimately will put many licensed engineers into the non-professional class and so will not be very acceptable to those who would have all licensed engineers classified as professional men, but it is to be hoped that the professional societies will not make an issue of it as logic is all on the other side.

Those who in the past have argued that all licensed engineers should be classed as professional men overlook important factors. Possession of a license to practice engineering does not make the possessor a professional man if the term "professional" has any significance other than as a convenient way for distinguishing between the technician and the engineman. The license is simply a certification to the public that the holder has the necessary qualifications to design safe structures. Many graduate engineers who have taken out a license against the day when they will be filling a position in which a license is required are now engaged in routine work in the design departments of large corporations which require only limited use of their engineering training. One such man may be working alongside a man of equal or even better engineering training who has not taken out a license. To say that the former is a professional man because he holds a license and that the latter is not because he is unlicensed is just as absurd as to say that for the same reason one is an engineer and the other is not. Yet much of the current thinking as to the significance of a license leads to such conclusions.

The definition of professional work which Mr. Andrews has promulgated will help to eradicate the confusion that this loose thinking has brought about. But most important, it will leave the great majority of employed engineers free to seek protection of the labor relations act or the labor standards act when and if they feel they need that protection. Failure of a man to be classified as engaged in professional work under the labor standards act in no way affects his standing as an engineer.

PICTURES IN THE NEWS

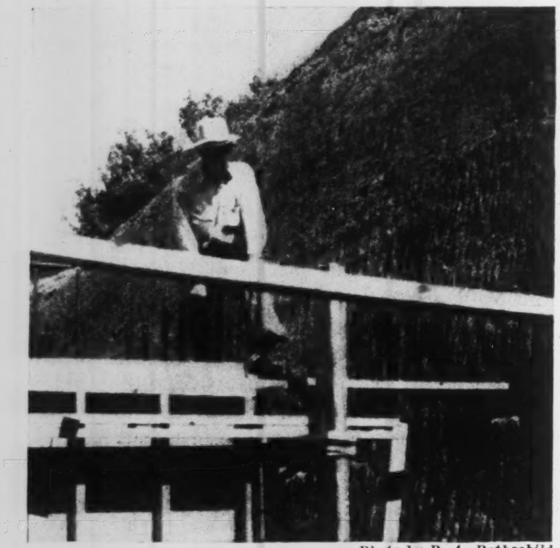


Photo by R. A. Rothschild

FOUNDATION DIGGERS PARADISE (*Left*) *Made six months before the picture was taken this almost vertical cut for the Alabama state archives building at Montgomery still stands without a slump. Samples in the 30 ft. of height analyze from 80 per cent clay at the top to 80 per cent sand at the bottom.*

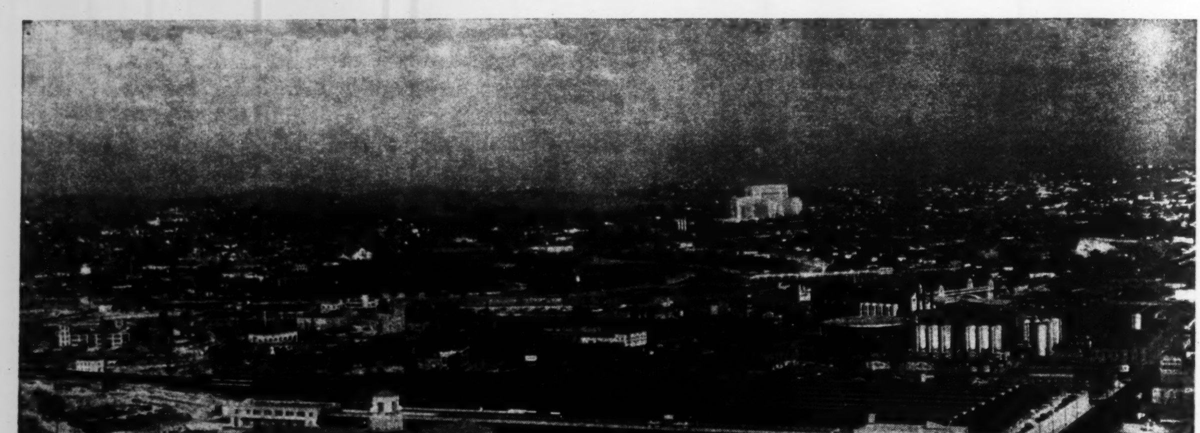


Photo by W. C. Sawyer

NEXT STOP—UNION DEPOT, LOS ANGELES. *After many years in separate stations with approach tracks often traversing city streets, railroads serving the City of Angels are now moving into this new Union Terminal located in the picturesque old Spanish quarter. The white stone building in the background is the Los Angeles County Hospital.*

Plywood Makes A Building

E. H. HORN
Harbor Plywood Corp., Hoquiam, Wash.

Laminated arches and wall and roof units built on stressed-covering principle are prefabricated for school gymnasium

AN unusual example of prefabricated plywood construction is afforded by a grade school gymnasium-auditorium building recently completed at White Salmon, Wash. The structure, with a floor plan in the form of a cross, is composed of a center unit and four wings, has a framework of glued, built-up arch bents of stressed-covering type, enclosed with prefabricated sidewall and roof panel units. Some 85 per cent of the material required for the building is Douglas fir plywood. The Speedwall Co., Seattle, Wash., prefabricators of plywood buildings, inspired the design and engineering and acted as general contractor. Walter H. Rothe, Yakima, Wash., was the architect. The construction principles utilized are similar to those used on structures developed at the Forests Products Laboratory, Madison, Wis.

The frame of the structure is composed of twelve sets of rigid bent arches of 43 ft. span and two sets of 61 ft. span resting on concrete footings. Head clearance in the gym is 20 ft. at the apex of the center dome, and a ridge of its roof is carried level on each of the wings. Steel tierods under the floor connect the arch footings. Three sets of the 43-ft. span arches are used on each of four wings that adjoin the central square, while the two sets of 61-ft. span arches cross the square on the diagonal. The legs of all arches are 20 ft. in length and are identical in construction and dimension; on the two arches for the central dome, the arms are extended to provide the greater span. Fabrication and erection of the arches was thus simplified through duplication. Fixed roof-tree plates and purlins were omitted from the frame, temporary ties being used until the enclosure panel units, which performed the bracing function, could be erected.

Fabrication was carried out in Seattle some 300 miles from the job. In making the arches the plywood cores were laid out to the desired contour to act as the form to which the stressed laminations of solid strips were applied. The cores, 10 in. thick, consisted of laminated segments of 9/16-in. rough sheathing-grade ply-

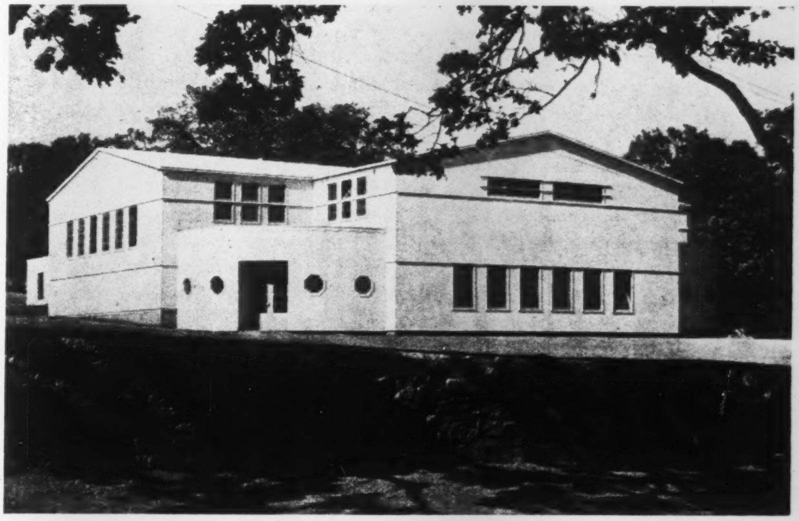


Fig. 1. School gymnasium in which glued plywood is principal material used in the frame and walls.

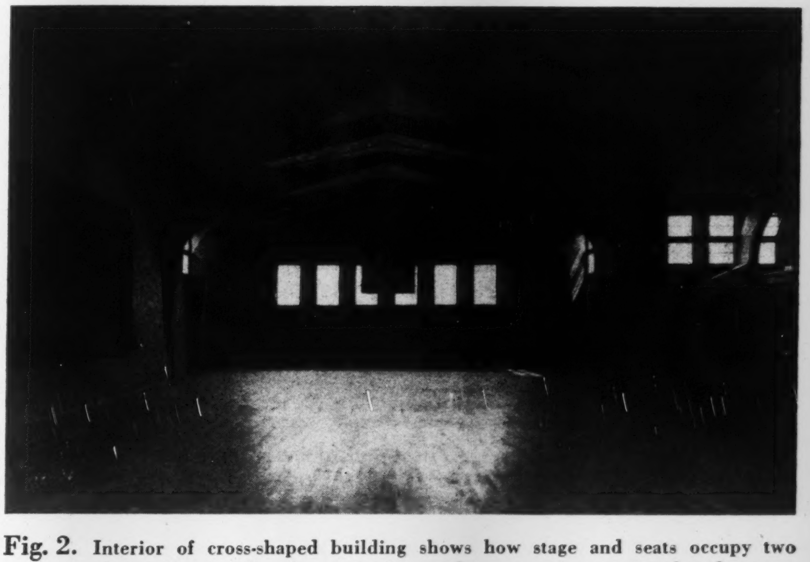


Fig. 2. Interior of cross-shaped building shows how stage and seats occupy two of the wings while other two wings and center unit compose the play area.

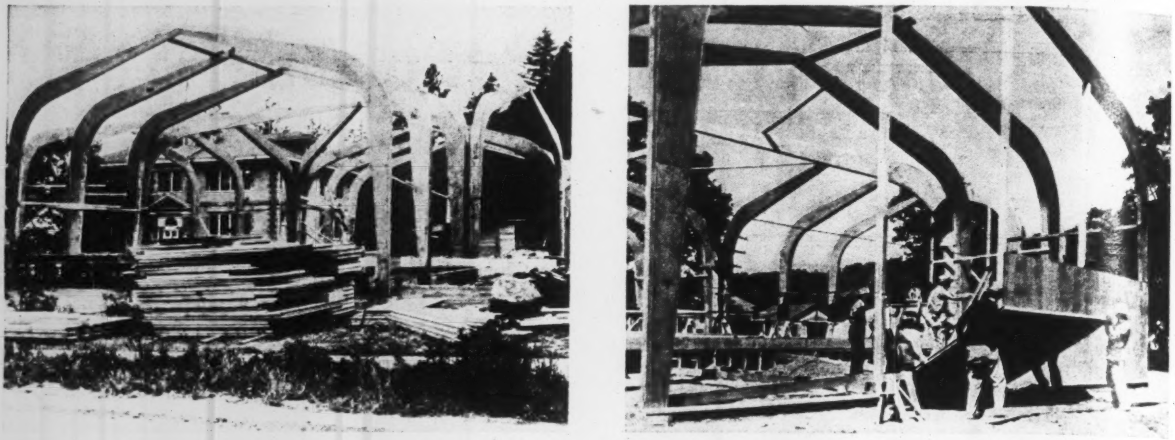


Fig. 3. Field erection was a simple procedure. The arches being raised in halves by hand winch while the wall units were set up by four men.

wood, with joints staggered on adjoining layers. Enclosing this core were four layers of 9/16-in. Douglas fir on the top, or tension side, and two layers on the bottom, or compression side, to serve as the stressed covering. Each layer consisted of a 4-in. and a 6-in. strip—the wide and narrow strips alternating in adjoining laminations. All joints in the laminations were scarfed. A self-bonding glue was used for both the cores and stressed covering. Nails and clamps were used to make contact while the glue set.

Each wall and roof unit was made of a size that would permit easy erection by 4 men; the height of the wall units conformed to the spacing of rustication courses. Framing of the units, made of $\frac{7}{8}$x1$\frac{3}{4}$-in. clear Douglas fir members, consists of horizontal plates between which are vertical spacers on 16-in. centers. On this framing an interior and exterior surface of 5/16-in. unsanded plywood was fastened with self-bonding glue which was set under pressure of nails. Rock wool insulation was placed in the units as they were fabricated.

Erecting the building

Halves of the arches were easily raised on the footings with a hand winch, and joined at the crown with connectors and steel gussets. The temporary tierods were then inserted while temporary posts supported the arches until other units were in place.

The wall and roof panel sections having been constructed to a predetermined schedule of sizes, numbered, and delivered to job, the start of application consisted of setting a level guide for the first row of panels, both for sidewalls and roof. The sections were brought to this guide line and glued to the legs or arms of the trusses. Pressure until the glue set was applied by blind nailing.

The section joints were rendered flush and invisible by a special detail. First the joints were uniformly enlarged with a high speed electric hand router, the cut extending into the supporting framing member. Then into the joint was inserted a spline which was fixed in place with the self-bonding glue. Finally, the surface of the joint was made smooth with a hand electric sander. This joint is considered distinctly superior to any method of butt joining with plastic or other fillers, and is patented by the Speedwall Co.

Finishing of exterior

The sidewalls and roof having been permanently fixed and glued into solid units, opening frames and trim were put in place in a simplified, although somewhat conventional manner. The flush joint system provided for any type of decorative and protective finish, but experience dictated that a high gloss paint should be avoided. Any irregularity or unevenness of surface is high-lighted by gloss finish, while a flat, or particularly a rough or textured finish, tends to minimize them.

On this job, therefore, a synthetic resin base plastic-type paint, made especially for fir plywood, was gunned on. Two coats were used. This paint provided a stucco-like texture, and while waterproof, fire resistant, and practically impervious to weathering, it is quite economical. The cost of application was 5½c. per sq.yd. The appearance is comparable to good stucco or masonry, and because of the light color, the surface has considerable insulation value by virtue of its reflectivity.

Conclusions

The objective of the designers of the structure was, in addition to the more practical motives, a rational consideration of a project that obviously called for emphasis on functionalism. Economy was a prerequisite, and yet it may be considered that the finished job lacks little from the standpoint of permanency or good taste.

The structure was so designed that, if wanted, a natural division of the floor area may be made for separate group play or instruction. As a gymnasium it has ample size for regulation play—both floor area and head clearance; all points on the floor are clearly visible from any seat in the seating section, with exception of the extreme corner seats which lack a view of one end. As an auditorium, it has adequate capacity and rostrum facilities for community gatherings. Although the capacity of the heating plant was reduced by one-third from the specifications given for an original conventionally-designed building, it has been determined that the lowest outside temperature will not require capacity firing. Finally, the building has exhibited remarkable acoustical efficiency.

Caulking Sewer Joints to Cut Leaks

JOSEPH LUSTIG

City Engineer, Janesville, Wis.

Sewage in main outlets in Janesville, Wis., was dammed and forced against the grade to unwater conduit while joints were caulked with lead

ELIMINATION of heavy groundwater infiltration into the outlet sewers of Janesville, Wis., was undertaken prior to the treatment of the sewage as required by the state Board of Health in its campaign looking toward the cleanup of the Rock River. By an ingenious method of dewatering the sewer through a series of dams and water ejectors which carried the sewage upstream to a bypass manhole it was possible to caulk the joints with precast strips of lead from the inside, essentially in the dry. A reduction of 5 m.g.d. in leakage from 7½ m.g.d. at low water and maximum of 10 m.g.d. at time of high water in the river resulted from caulking 1½ mi. of 48-in. and 1 mile of 54-in. outlet sewers.

The sewerage system of Janesville was well planned in that it provided for a 48-in. main outlet sewer which discharged into the river well below the city. This sewer serves the major portion of the built-up areas. A second 54-in. main outlet sewer discharges into the river from the opposite bank. It was constructed in 1920 and while at the present serves only a local and sparsely populated area it will be extended, when needed, to provide for the future growth of the city beyond the areas which can be served by the system drained by the 48-in. sewer.

In 1932 the city determined to cooperate with the bureau of sanitary engineering of the state Board of Health in its program of securing at least primary treatment of all domestic sewage discharging into Rock River by Dec. 31, 1935, and the engineering department of the city was instructed to proceed with plans for a treatment plant to be financed by the city with the aid of a PWA grant.

When the first flow readings were taken at the outlets of the two main sewers a rather startling condition was revealed. The flow from the 48-in. main outlet sewer which served a connected population of 19,000 persons was found to be at the rate of 4.07 m.g.d. during minimum flow and 5.3 m.g.d. at maximum. Since these readings were taken during extreme low water stage in the river it was quite obvious that, with an average water pumpage of 2 m.g.d., something was decidedly wrong.

Flow readings taken at the outlet of the 54-in. sewer disclosed a discharge of 3 m.g.d. from an area which at present serves a connected population of only 600 persons. This condition was obviously one that required investigation and correction before sewage treatment could even be considered. Both outlet sewers throughout their entire length lie below the groundwater level, with the exception of the outlet ends which discharge into the river below a power dam. The natural assumption was that infiltration or leakage was responsible for the heavy flows.

Preliminary investigation of the methods employed in the construction of the 48-in. sewer, which was built in 1908, led to the belief that the greater portion of the leakage was occurring in this 7,000-ft. stretch of sewer. Further investigation confirmed this suspicion.

The upper end of the 48-in. sewer lies near the river at the junction with an inverted siphon across the river and a 27-in. sewer to the north. (See Fig. 1).

A sluice gate was placed in the manhole at *A* and the sewage from the 27-in. sewer was diverted into the river from the manhole at *A* against grade through the 36-in. sewer to a temporary outlet which was made in the manhole on the west end of the inverted siphon. The sewage from the east side was bypassed into the river at the manhole on the east end of the siphon.

It was now possible to enter the 48-in. sewer. An examination of the joints revealed an enormous amount of leakage into the sewer from the lower one-third of almost every joint. This sewer was constructed using a precast concrete pipe having a bell-and-spigot type of joint with a joint slot on the exterior of the pipe. The method employed in making this joint consisted of placing a metal band around the pipes at the joint and then filling this slot with a cement grout poured into the slot opening from the top of the pipe. It is quite

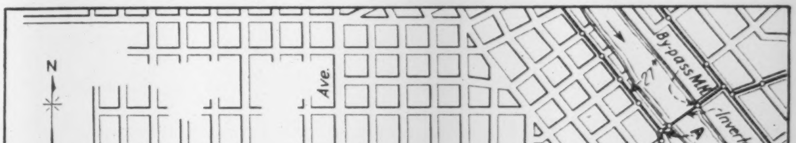


Fig. 1. **Janesville's main outlet sewers lie on opposite sides of the river, mostly below groundwater level.**

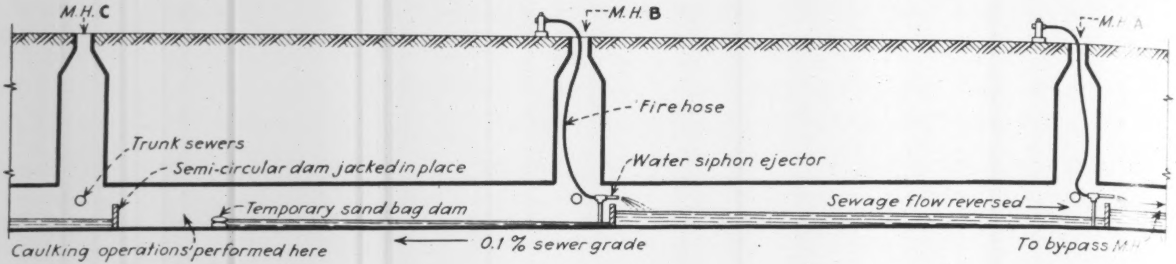
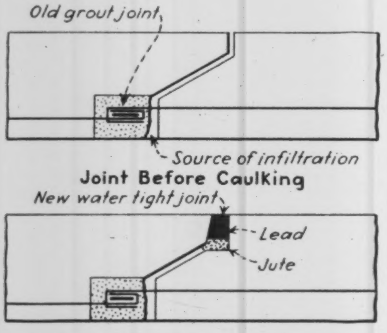


Fig. 2. Method of siphoning sewage against grade to dewater the sewer at points where joints were being caulked.



Joint Before Caulking

Joint After Caulking

Fig. 3. Detail of the caulked joints.

evident that the contractor was unable properly to dewater the excavation and that the grout was poured into these joints through water with the obvious results.

A method of caulking these joints and a means of doing this work without interfering with sewer service now had to be devised. After considerable experimentation with asphaltic materials it was decided to use precast strips of lead as a caulking medium. These 6-ft. strips were cast in various widths ranging from ⅜ in. in thickness to ¾ in. in thickness and 1¼ in. wide. They were to be inserted in the joint from the inside of the sewer where the pipe butted together. Since the upper half of the joint was in good condition in most cases, the lead caulking was carried on only below the spring line of the pipe. Where the pipe butted tightly together it was necessary to provide a slot of uniform width to receive the lead. This was accomplished by means of air chisels, and the subsequent caulking was done by means of air-operated caulking tools. All opened joints were then slightly "keyed" to provide anchorage for the lead.

In carrying on the work the problem of handling the sewage from house laterals and at street intersections was solved in the following manner. Work was commenced at manhole *A* by jacking a semi-circular wooden plank dam in the sewer just ahead of the work so as to keep back the water in the sewer from downgrade which was 12 in. deep at this point. A 1½-in. water-operated ejector was then used to dewater the section in which work was being carried on. The suction pipe of this ejector consisted of a short length of 1½-in. hose which was held on the bottom of the pipe at the joint thus picking up the water welling up through the joint and discharging it into the sewer ahead of the work. By this method of dewatering the section in which caulking operations were being carried on, a practically dry bottom resulted and permitted the use of the air chisel for widening the joint so as to receive the lead. As soon as a short section of joint was opened oakum was rammed into the bottom of the slot which shut out the increasing flow of water and sand resulting from the opening of the joint. After widening the joint the full half perimeter of the pipe the 6-ft. strip of lead was rammed in place and caulked until a tight joint was obtained.

As work progressed downstream the sewage entering the main from house connections was held back by means of a semi-circular dam jacked in place behind the point of caulking operations. This ponded sewage then was forced to flow against grade to manhole *A* at which point it was picked up by means of a 4-in. water-operated ejector and discharged over the gate bulkhead into the 36-in. sewer and thence into the river through the west siphon manhole. When the work had progressed for a distance of six blocks to point *B* a semi-permanent dam was jacked in place and another 4-in. ejector picked up the sewage as it ponded behind the point of operation downgrade until point *C* was reached at which point another semi-permanent dam and ejector were placed in the sewer. By the installation of these water-operated ejectors along the line of the work the entire accumulated sewage flow in a section ultimately reaching a length of 7,000 ft. was being stepped up over the successive dams and being discharged into the river from manhole *A*.

The advantage of this method of handling the sewage over one utilizing pumps along the line were numerous. The pumps would have required installation in pits cut in the pavements so as to reduce the suction lift which at most points would have been high. The use of pumps would have entailed constant maintenance so as to prevent shutdowns with the resulting "drowning out" of the caulking crews. The ponded sewage would have become septic with resulting danger to workmen from sewer gas. The water operating the ejectors tended to keep the sewage fresh at all times. Furthermore, the city owns the water utility so that the cost of the water used in operating the ejectors was only that of the additional current used in pumping.

The work was carried on as a continuous operation using three crews of four men each working 8-hr. shifts. The crews consisted of a compressor operator, one cutter and one caulker with liaison man supplying materials from the rear manhole. The entire cost of caulking 7,628 lin. ft. of the 48-in. sewer was $7,476.10 or $0.98 per foot of sewer with joints at 3-ft. intervals.

Final flow readings taken after the completion of the work showed a minimum rate of flow of 1.2 m.g.d. and a maximum of 2.3 m.g.d. indicating a 3.0-m.g.d. reduction of groundwater leakage.

The high minimum rate of flow is accounted for by reason of the leakage into the 27-in. sewer extending north from manhole *A* which also lies below groundwater and cannot be caulked owing to its small size and other difficulties which have not been overcome to date.

The problem of reducing leakage in the 54-in. main outlet sewer lying on the south side of the river was a more difficult one in that about one-third of the 3-m.g.d. discharge was found to be due to leakage into the smaller feeder sewers of which there are about 3½ miles, 2½ miles of which are either partly or entirely under groundwater, depending upon the height of the water in Rock River. The range of the water in the river is from El. 82.8 to 89.5.

The total discharge of five out of eight contributing sewers was 288.5 gal. per min. at low water of El. 82.8, 519 gal. at El. 83.44 and 954 gal. at El 86.7. For all eight tributaries (three had submerged outlets at high river stages and the discharges had to be estimated) the discharges are as follows: 0.509 m.g.d.; 1.017 m.g.d.; 2.000 m.g.d. (est.). The infiltration into the 54-in. was fairly constant, at low river 2.121 m.g.d. and 2.153 m.g.d. at average river stage.

The 2-m.g.d. leakage found in the main 54-in. sewer was eliminated by the same method employed on the 48-in. sewer by caulking the joints with lead from the inside of the pipe. The remaining 1 m.g.d. cannot be eliminated unless these smaller contributing sewers are relaid with iron pipe or relaid with a type of sewer joint which will assure leak-proof joints. The joints used in laying the 3½ miles of smaller sewers was of bituminous material which depends on compression for its effectiveness.

The writer is of the opinion that all sewers which are to be laid below groundwater level should be of cast-iron pipe in the smaller sizes as the additional cost of such construction will bring large returns to the community in the shape of reduced costs for the construction and operation of sewage treatment works.

The work was carried on under the direction of the city engineer over a period of two years during the winter months using employees of the Department of Public Works.

Squatter Warfare for Water

W. W. DeBerard

Associate Editor, *Engineering News-Record*

Trouble is brewing along the Mexican border where uncontrolled by law or treaty, Texas and Mexico are heading toward a showdown in competitive appropriation

Trouble is in the making along the Rio Grande. For 1,300 miles the river forms the boundary between the United States and Mexico. In theory the citizens of both countries are entitled to peaceable and equal use of its waters, but overdevelopment of the fertile valley lands along its lower reaches is giving rise to an acute international problem. Some day, when the years of low flow come in sequence, this problem may involve the whole country in controversy.

From Brownsville to Rio Grande City the lower valley is occupied by an agricultural population of 175,000, wholly dependent on irrigation water from the boundary river. Most of this growth is on the American side, and America has been taking almost all of the river's water. But Mexico is now developing land actively and aggressively, and in due course will be taking at least as much as Texas is taking. It seems to have good right to do so, since Mexico supplies twice as much water below El Paso as does Texas, although Texas is now using more than twice as much as Mexico.

Already more lands are developed for irrigation on the American side than the entire low flow of the river can supply—witness definite shortages that developed this year, when for ten days in April and a number of days in May and June no water passed San Benito pumping station, supply source of a large part of Cameron County Irrigation District 2; the half-dozen districts downstream of this point had to depend on scanty amounts of underground and return-flow water. With this condition, and with Mexico busily engaged in building dams on its own tributary streams to irrigate Mexican lands, where retention and use will

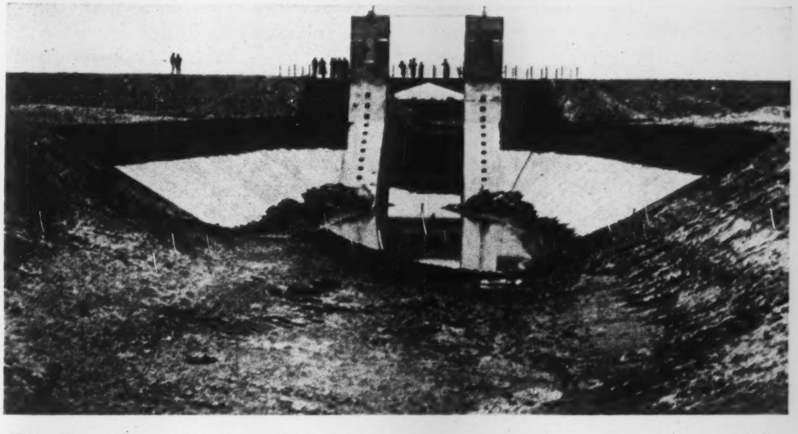


Fig. 1. Retamal headgates in Mexico can divert all the Rio Grande's low flow.

materially cut down the flow in the main river, the chance of future trouble is well beyond question.

If the controversy were limited to the population in the river valley alone it might not appear so serious, but back of the immediate interests there is a much wider interest, which greatly increases the seriousness of the whole situation. Vast amounts of securities have been issued on valley properties, and these securities have been sold and are now owned all over the country. It is said that scattered throughout the midwest, as far north as Chicago, something approximating 400 million dollars' worth of Rio Grande valley securities is owned by investors. If and when a water shortage hits the valley and destroys crops, and perhaps in a second year of shortage kills the trees and throws the whole region into bankruptcy, the entire investment is in jeopardy. So the valley farmers are likely to have a large backing of potential allies far to the north, when increasing Mexican use of water makes the threat of drought ruin a reality.

Not enough water

As in practically all irrigation projects more land than water is available. It would seem that the water users should divide what water there is on some basis of rights. But lack of a water plan makes it difficult to get at the facts. Lack of adjudicated rights casts a cloud of legal doubt. Both cause a confusion that complicates diversion.

A study on the ground disclosed the complexity of the situation. An age-old restrictive treaty stands in the way of dam building clearly indicated as essential. Irrigation grew up without much thought for the ultimate necessities, now the Mexicans are actively bringing the problems into focus. Conservation of wasted floodwaters would help.

Acreage of developed land

It is not easy to acquire dependable figures on acreage cultivated, on acreage irrigable, on acreage in brush for which plans have been made for future development or on the necessary water to make that development possible.

Irrigation in the lower valley did not exist prior to 1900. By 1932 it had reached 350,000 acres in the two lowest counties, Cameron and Hidalgo. Now 600,000 acres are under irrigation works of 30 districts and more than 350 individual tracts.

On the Mexican side in the lower valley plenty of irrigable land exists but less than 5,000 acres are irrigated. The recently built Retamal headgate diversion structure, opposite Donna, Tex., can divert all of the low flow, perhaps 1,000 sec.-ft. Gates have not yet been installed, the concrete opening being temporarily bulkheaded off. A canal has been cut through the levee and high ground near the river. Some water has been diverted. A recent news report indicates that a 250,000-acre development is planned. This, it is stated, is to be increased ultimately to 450,000 acres.

From a report by the U. S. Section of the International Boundary Commission made in 1932 but still unpublished which contains unofficial statements of members of the Mexican Section are taken the following figures as to irrigated acreages in the two counties: In the United States on the Rio Grande below Ft. Quitman, in 1932, 376,000 acres were irrigated, of which 95 per cent was in Cameron and Hidalgo counties. The total ever irrigated was 472,000 acres, and the irrigable areas under existing works is 582,000 acres of which 91 per cent is in the two counties noted. On the Pecos River 40,000 acres are irrigated and 50,000 acres more are under existing works. On other tributaries there is only nominal irrigation apparent. These are 1932 figures, but the situation has not changed materially since that time.

In Mexico the Rio Grande furnished water to 25,250 acres in 1932. The 1932 irrigated areas of the seven tributaries is given as 358,800 acres with an estimated future extension to 598,000 acres. Quite obviously these figures for Mexico are for the present irrigable areas and future possible extensions, since the San Juan development at El Azucar was only started early in 1938. It is set down for 198,000 acres as "Irrigated area 1932" and 220,000 acres for future development.

In 1937 the Texas Board of Water Engineers, which issues permits for withdrawals of floodwaters only, since riparian owners are entitled to the "normal flows," reported the following status of the Rio Grande acreages below Ft. Quitman. Permits had been given for water for 471,519 acres. Appropriations were on file for 1,598,517 acres less a duplication of 768,415 acres, giving a net of 1,301,621 acres. Areas holding riparian rights amounted to 36,490 acres additional. In this total of 1,338,111 acres, 319,794 acres were of undeveloped land giving 1,018,317 acres as the net total in 1937 looking to the main stream for water. However, 450,000 acres is the maximum acreage that has been irrigated in any one year. On the tributaries, permits have been granted for 10,084 acres and appropriations on file call for water for 237,543 acres. The sum of the areas represented by permits, appropriations on file and riparian areas less duplications on the main stream and tributaries is 1,585,738 acres.

From the office of W. E. Anderson, consulting engineer, San Benito, was obtained a somewhat different set of figures. (See Table I). They are brought up to late 1937 and are segregated by counties. The total irrigable area of 2,008,697 acres, one-half of which is called "active," is not to be compared exactly with 1,585,738 acres in the report of the State Water Engineers, but either figure indicates far more land than water is available.

A. C. Tamm, consulting engineer, Harlingen, for many years has kept records of the acreage in four counties: Cameron, Hidalgo, Willacy, and Starr, noted in Mr. Anderson's Table I. For 1937 he gives in 29 active districts and 124 small independent systems the following acreages: Acres in brush, 120,393; cultivated, 401,817; irrigable, 522,210; exemptions for railroads, canals, 106,234; gross area, 628,444. These figures do not include Willacy County which he calls inactive although it had 60,000 cultivated by dry farming and 69,200 in brush. Other figures in inactive districts bring the grand gross total to 861,604 acres in the four counties.

Water available

Since there is more land than water it is the essence of the problem to learn what water is available, especially as heretofore development seems to have gone ahead on the basis of an inexhaustible source. A water shortage is the last thing the Rio Grande valley enthusiast talks about.

Like earthquakes on the Pacific Coast, talk of water rights is taboo. Few know the facts and if they do they say little. Perhaps it is a hangover from the boom days when Middle West prospects were brought in by the trainload to see only what the glib land salesmen thought best. Many people are not interested in available water. If too much were known it might hurt business. When the subject is brought up, invariably one hears an appeal for a treaty with Mexico which would permit the construction of dams on the main river for the storage of flood waters.

A treaty needed

Almost since the beginning of the present development the desirability of a treaty has been voiced continuously but the situation in this respect has not changed and is not likely to change soon. Careful inquiry leads to the conclusion that this ordinarily preliminary step of assurance of available water was brushed aside by the early land sharks as inconsequential. Later, those who came from Florida after the boom broke there did not care to have the question brought up. In fact many people still insist that the matter not be agitated.

For 13 years official flow records have been kept and published by the International Boundary Commission, United States and Mexico. A résumé of the average flows for the period 1924-1936 at proposed damsites in three sections of the river with contributions from each side are noted in the table of average annual contributions in the adjoining column.

Down to the damsite at Sullivan Springs the contributions by the two countries are essentially equal. In the next stretch of the river down to the Salineño damsite Rio Salado brings the Mexican contribution to 56.1 per cent of the total. Two more tributaries from the Mexican side down to Rio Grande City with only minor additions from the north raise the Mexican contribution to 65.5 per cent. Thus in an average year nearly two-thirds of the 5,320,300 acre-ft. of water available to the Lower Rio Grande Valley projects comes from a foreign country.

What is the situation today as to actual use of water? How much is diverted now? What of the future? According to the I.B.C. figures,

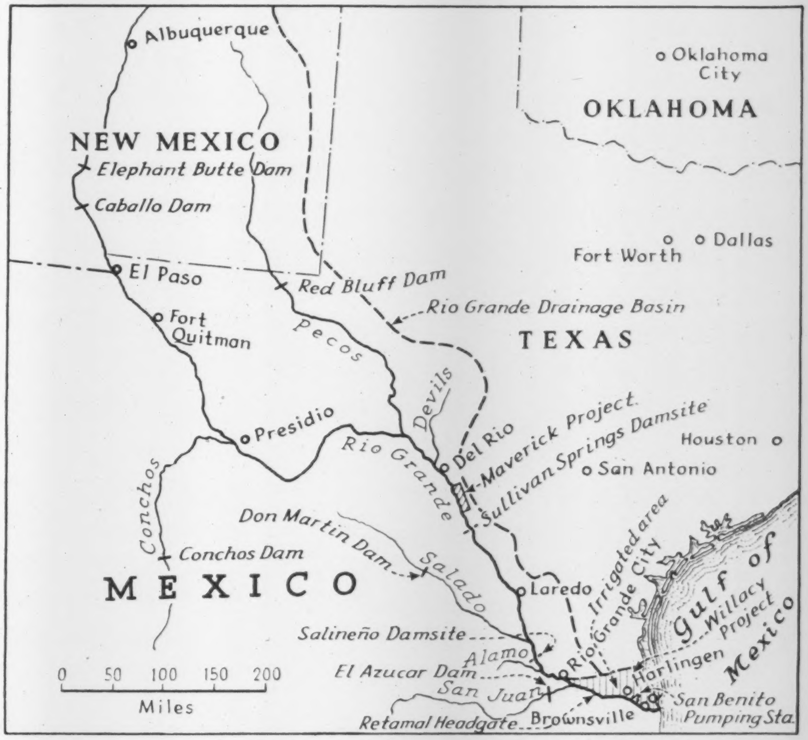

Albuquerque
NEW MEXICO
Elephant Butte Dam
Caballo Dam
El Paso
Fort Quitman
Red Bluff Dam
Pecos
Rio Grande Drainage Basin
TEXAS
OKLAHOMA
Oklahoma City
Fort Worth
Dallas
Devils
Presidio
Rio Grande
Del Rio
Maverick Project
Sullivan Springs Damsite
Houston
San Antonio
Conchos
Conchos Dam
Don Martin Dam
Salado
MEXICO
Laredo
Irrigated area
Rio Grande City
Gulf of Mexico
Willacy Project
Salineño Damsite
Alamo
El Azucar Dam
San Juan
Rio Grande City
Harlingen
San Benito Pumping Sta.
Brownsville
Retamal Headgate
0 50 100 150 200
Miles

Fig. 2. The Rio Grande gets two-thirds of its water from rivers rising in Mexico. Major use of the water is on the American side in the delta region below Rio Grande City.

TABLE I — TOTAL IRRIGABLE AREAS BY COUNTIES

Counties	Active Areas	Additional Area	Total Irrigable	Area actually irrigated — average for years 1928–1937
Cameron	293,416	123,000	416,416	107,000
Hidalgo	473,795	156,000	629,795	153,000
Willacy	86,000	95,000	181,000	....
Starr	33,136	20,000	53,136	500
Zapata	3,600	145,000	148,600	400
Webb	39,484	200,500	239,984	9,000
Maverick	60,000	150,000	210,000	4,000
Kinney	3,760	90,000	93,760	2,000
Val Verde	810	200	1,010	400
Terrell	....	1,000	1,000	....
Brewster	420	600	1,020	400
Presidio	19,595	5,400	24,995	10,000
Hudspeth	3,680	4,300	7,980	1,200
Totals	1,017,696	991,000	2,008,696	287,900

TABLE II — AVERAGE ANNUAL CONTRIBUTIONS IN ACRE-FEET TO THE RIO GRANDE FROM 1924–1936

From Ft. Quitman to Sullivan Springs Damsite			
Mexican Tributaries		U. S. Tributaries	
Rio Conchos	1,007,700	Residue in Rio Grande at Ft. Quitman (Considered as a U. S. Tributary)	220,000
		Pecos River	340,700
		Devils River	523,000
Others	665,600	Others	626,900
	1,673,300		1,710,600
From Sullivan Springs to Salineno Damsite			
Rio Salado	533,900		
Others	94,100	Various small	93,100
	628,000		
From Salineno to Rio Grande City			
Rio Alamo	145,000		
Rio San Juan	1,006,000	Various small	34,000
Others	30,300		
	1,181,300		
Grand totals	3,482,600		1,837,700

present consumptive use of water in acre-ft., *ie.*, the amount permanently withdrawn and not returned as seepage or drainage, varies from 2.5 acre-ft. per acre at the upper end of the basin to 1.6 in the Lower Valley. The total United States withdrawal is estimated at 867,000 acre-ft. of which 638,000 is from the main stream in the lower valley. The future consumptive use in Mexico is estimated at 1,381,000 acre-ft., practically all taken from the tributaries.

Mr. Tamm has kept track of diversions in the lower valley since 1923. The high year was 1927 when 860,000 acre-ft. was withdrawn. The low year was 1933, at 505,000. The recent years show some 10 per cent increase over the low year.

As the Texas Board of Water Engineers has determined the duty of water at two acre-ft. per acre of gross area, more than 3,000,000 acre-ft. of water is indicated (on the basis of 1,585,738 acres for which rights of some kind exist) as needed for the present development whereas there is but 5,320,300 acre-ft. average total flow at Rio Grande City of which the United States contributes only 1,837,000 acre-ft. Obviously, storage is needed of water contributed by both countries; and from that storage the Lower Rio Grande Valley development in the United States needs more water than this country contributes.

Storage possibilities

Mexico is building storage of its contribution to the Rio Grande on its own streams and in consequence is not interested in the main river from which the Mexicans take little.

In 1926 Mexico adopted a new irrigation policy. The National Irrigation Commission reported possibilities on the Mexican tributaries noted in Table II. Projects on Rio Salado (the Don Martin dam to serve 165,000 acres), on the Rio Conchos (the Conchos dam to serve 165,000 acres), and works on the Rio San Diego to serve 40,000 acres, are completed. A fourth project, on Rio San Juan (the El Azucar dam to serve 150,000 acres), is one-third completed. Losses by seepage, evaporation and irrigation caused by these developments will materially decrease the Mexican contribution to the main river above the major portion of the irrigated development in Texas. This depletion of the supply, two-thirds of which originates in Mexico, by a rapid upstream development using water from the Mexican tributaries is noteworthy; it is the gist of the emergency character of the situation.

Having an actual demand in the United States for water equal to the supply and with that demand coming from only a portion of the active acreage provided with facilities, one may well question the feasibility of plans for development of more acreage. Yet within the last few years several large new projects have been planned, financed and built and are about to go into operation. Both in the valley and on the tributaries these developments in Texas have been allowed to go ahead without protest or legal injunction. The Maverick County and Red Bluff projects are comparatively new. The 75,000-acre Willacy County Project is the most recent example. To this project Mexico as well as the old established districts in Cameron and Hidalgo counties might well object. Mexico has the means to do it effectively through operation of the Retamal diversion headgate with its sill well below the bed of the river. Everyone who knows says that the valley needs more water, but instead of trimming out some of the existing acreage large areas are being added. Strange as it may seem certain officials indicate that it is wise forehandedness to get as much land as possible into projects prior to final settlement of the question of water apportionment between the two countries. Granting of excessive permits on this premise is sure to entail disastrous conflicts and serious losses.

In view of this situation, development of storage at the three dams noted in Table II would seem to be highly desirable and about the only way to avert coming water shortages in the low-flow cycle.

Due to the erratic flow of the Rio Grande and the variation of the irrigation demand, which comes at the low-flow cycle of the river, great quantities of unused water discharge into the Gulf and yet at times the demand exceeds the supply. Regulating reservoirs in the main stream are thus indicated. Logically this brings us to a discussion of the treaty situation since dams are obstructions specifically forbidden under an existing covenant.

First, the existing treaty situation needs understanding. From El Paso to Ft. Quitman, 85 mi., the river is under the international water treaty of 1906. Downstream to the Gulf no treaty or agreement defines the water rights of the two countries. The 1848 treaty of Guadalupe prohibits obstructions in the river. In this stretch of 1,215 mi. as noted in Table II the principal tributaries are the Pecos and Devils River from the United States and the Conchos, Salado and San Juan from Mexico. Two-thirds of the water comes from the Mexican watersheds in an average year.

In round numbers, the Texas projects need to draw from the river on the average 1,000,000 acre-ft. of water which comes from the Mexican contribution. Our neighbor to the South has taken care of its own storage requirements on its own tributaries. Storage in the United States is limited to that back of the Red Bluff Dam and in a revamped shallow reservoir for the Willacy County Project.

Thence arises the diplomatic situation of Mexico not being interested in main stream storage. The trading position is obvious and some *quid quo pro* is apparently necessary. That most frequently mentioned is Colorado River water. Some Lower Valley enthusiasts are naive enough to believe that the representatives of the California citrus interests might be willing to grant Mexico several million acre-ft. of Colorado River water in perpetuity so that the Lower Rio Grande Valley might get from Mexico more water to produce additional surpluses to glut an already hard-pressed competitive citrus market.

As this observer sees the situation, no one of the senators from the seven states in the Colorado basin is likely to vote to ratify a treaty which will give Texas such a trade advantage. Further as the valley's future water needs can come from but one source and that in another country, direct barter methods will have to be utilized. Probably a cold cash settlement is the simplest solution.

Texas is in a more favorable position than any other of the western states might be to enter into negotiations where a contribution may become necessary because when it entered the Union it retained all of its public lands and natural resources such as oil and gas which as concessions have become decidedly lucrative. This fact explains why the Reclamation Bureau (until recently financed largely from funds received from the sale of public lands and royalties on natural resources) has done but little work in Texas. That state has never contributed to the Reclamation fund. In some quarters it is felt that the enormous returns to the state from royalties might well be utilized at least in part toward the acquisition of a more stable water supply on the Rio Grande. The state might contribute to the building of dams on the main streams, leaving to the federal government the settlement costs. In making this settlement the question of water rights will arise before and after the treaty is signed.

An attempt is now being made to unite all agencies in the valley in a drive to enlist state and national officials to obtain a treaty which will permit construction of main river dams. In June when the river all but went dry 1,000 telegrams of appeal were dispatched to Washington. But the State Department, as one engineer put it, is primarily interested in making peace terms. Peace presupposes a controversy. Perhaps, he said, a new Boston Tea Party in the way of a skirmish of water-thirsty ranchers and Mexican guards at the Retamal diversion headgate would bring the State Department into action. No John Brown is in evidence as yet, but one may arise when his trees die.

Water rights

Texas is a riparian state by the nature of its old Spanish land system, and the basis of water rights is riparian ownership. However water is being taken in part under state permits giving an appropriation-right basis. Such adjudication as has been carried out put these permit grants in the class of registrations, the Water Board engineers being under the necessity of issuing permits whether the water is available or not. Priorities are non-existent except as between riparian rights and permits since the latter are valid only after riparian uses are satisfied. In effect the permits are a kind of right to excess or flood waters which may be taken for storage without injury to riparian needs. In consequence of this lack of priorities the operation of the river becomes one of gentleman's agreement, the lower stream diverters traveling to the head of the valley and requesting upstream operators to curtail or equalize their diversions with that of their neighbors downstream. As long as the low-flow periods were short this method of operation worked satisfactorily, but commercial rivalry eventually will cause trouble.

Flood problems

Interlocked with the water supply problem is a flood hazard of no small proportions. The lower valley is of delta formation with the main river unable to carry the flood flows, thus necessitating floodways as well as levees along both sides of the river. An agreement negotiated by the I.B.C. arranged for a flood of 200,000 sec.-ft. to be apportioned to the various floodways in the two countries. In the 1932 highest-of-record flood, 198,750 sec.-ft. was registered at Rio Grande City 25 miles above Penitas. An article describing the flood situation appeared in *ENR* p. 407, March 19, 1936. Mention is made here of floods only to indicate one of the hazards of the area and to point out that it is being cared for by the I.B.C. through federal appropriations indicating a financial interest of large proportions.

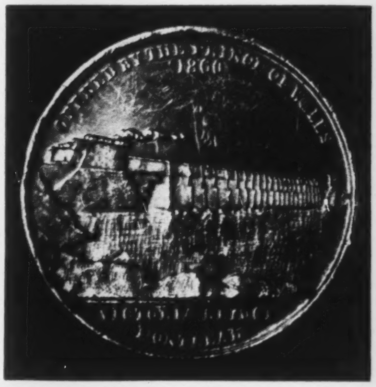
Seepage

Another hazard is the question of rising ground water due to seepage from the irrigation operations. Seepage is augmented in the lower valley since most of the irrigation water is distributed through canals built in embankments above the surrounding land. The general slope of the land is very flat and away from the river. The losses are so great that a large mileage of the canals is lined and one district, the Pharr-San Juan, has put the major portion of its distribution system underground in concrete pipes made in its own factory with WPA assistance. Yellow leaves on citrus trees in groves in the lower areas tell the experienced observer that seepage has arrived to ruin that particular property. So far little drainage work has been done. In the revamped Willacy County Project, however, an elaborate drainage system is under construction. Along the North Floodway in the enlarged and deepened section provision is made to care for drainage outlets from adjacent properties. The U. S. Geological Survey and the State Water Engineers are now collaborating in an elaborate groundwater survey in the valley with a view to controlling seepage where this may prove to be necessary.

With financial interests ramifying generally over the country, with a score of engineering problems of major import in the hydraulic and irrigation field, with an unprecedented water-right situation wherein priorities are essentially non-existent, with the whole future of the valley dependent on international amity, on accord and readjustment of a 90-year old treaty, the problem of the Lower Rio Grande Valley is a challenge to the ingenuity of statesmen as well as engineers. We shall hear more of it.

Oldest Bridge Medal?

An OLD MEDAL commemorating the opening of an important bridge was brought to light by the publication in these pages of a picture showing the medal recently issued for the opening of the Middletown-Portland Bridge in Connecticut (Aug. 25, p. 222). The old medal, one side of which is reproduced herewith, was issued in 1860 when the Prince of Wales opened the original Victoria Bridge over the St. Lawrence River at Montreal. The medal is of britannia metal, about the size here shown. Its age, 78 years, raises the interesting question of whether it is the oldest bridge medal to be issued on this side of the Atlantic.



VICTORIA BRIDGE MEDAL

A Neat Repair Job

John E. Faigle

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Disintegrating concrete in an old wharf at the Key West, Fla., naval station accompanied by a slip of the land fill, was recently shaped up into a neat appearing structure by a simple use of steel sheetpiling. The old wharf indicated by the lighter lines in Fig. 2 was constructed in 1911–12. It was 1,100 ft. long with one break at about midlength where a 54-ft. wide slip for a marine railway was introduced. The wharf structure consisted of a level deck 40 ft. wide and at the back an inclined apron deck to hold the backfill; both decks were carried by six-pile bents spaced 10 ft. apart of reinforced concrete piles capped by transverse beams. Fig. 2 indicates the old structure plainly enough and emphasizes by heavier lines the parts added in the reconstruction.

A neat adaptation of simple equipment got some notably fast work in driving sheetpile wall. Two wales, projecting 1 ft. from the existing wharf, were erected from old lumber to act as guides for driving (Fig. 2). The top wale was low enough to allow the hammer to drive the piles ½ in. below the deck. The bottom wale was placed just above the water. The piles while being threaded were pulled back against the wales with a block and tackle operated by two men in a boat underneath the wharf.

To speed up the work separate units were used to thread and to drive the piles as shown by Fig. 1. A medium-weight crawler crane was used for the threading; as shown by Fig. 1 the crane traveled on mats, one under each tread, of three 12 x 12-in. timbers bolted together and arranged to break joints when placed. The driving unit was a stiffleg derrick on rollers, supporting a double-acting steam hammer. A sliding guide was bolted to one side of the hammer which worked up and down on leads of 10 x 10-in., 57-lb. H-section beams suspended from the boom, and braced back to the derrick frame near the bottom. By this means the hammer was always held plumb on the pile, and since the derrick traveled parallel to the line of driving, it was seldom necessary to perform any other manipulation than that of raising and lowering the hammer. Also, due to the constantly plumb position of the hammer, there was practically no battering of the pile heads though in the harder rock occasional piles were driven for 30 min.

A maximum of 45 lin. ft. of piling per day was threaded and driven but the average was considerably lower due to obstructions buried in the mud. A total of 870 sheetpiles were driven in 54 working days, this period including the time taken to shift across the slip. The total length of sheetpile wall was 1412 ft., the average driving distance per day thus being slightly over 26 ft. The piles were driven a minimum of 3 ft. into the rock, greater penetrations being necessary along most of the south section to provide for future deepening to 22 ft. at mean low water.

The sheetpiling was delivered on truck trailers. An unloading chart specifying unloading locations along the wharf for various lengths was made up beforehand, and the hauling contractor was directed to unload the steel according to the plan. As furnished, the piling was red-leaded for a distance of 10 ft. from the top. Immediately after threading, the top 10 ft. of each pile was given an additional coat of fast-drying red boot-topping paint. This dried in the 24 hr. between threading and driving.

Actual construction costs are expected to be as follows, the comparatively small unfinished portion of the work being estimated:

Materials	$64,590
Labor	17,240
Total	$81,830

The labor costs of pile driving were $3,870 or $2.74 per ft. of wall.

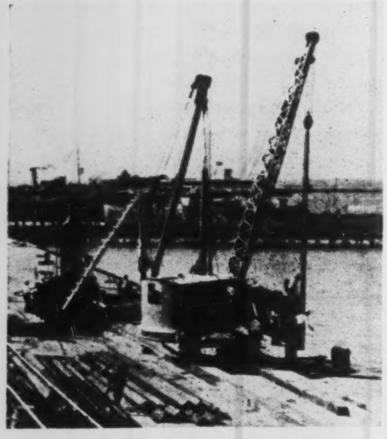

Fig. 1. Job assembled sheetpile driving outfit armors wharf front.

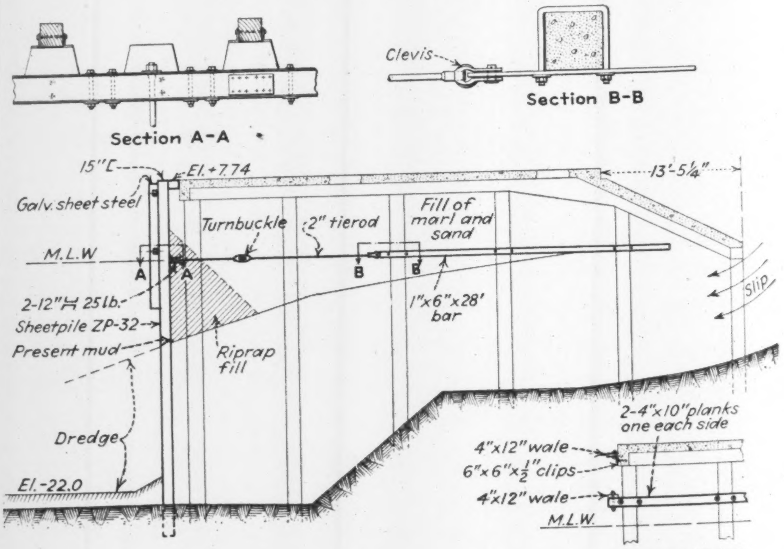

Fig. 2. Steel pile facing restores usefulness to old Key West naval-station wharf; heavy lines show additions to old structure.

Changed Condition Under Contracts

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In construction contracts, when are changed conditions a legal claim for redress on the part of the contractor?

Since this article was written, Mr. King, the senior author of this article, has died.—EDITOR

SET forth in the panel on this page is a protective article contained in current federal construction contracts. It calls for careful reading and understanding by contractors. Let us look at what it says. Primarily it provides that when, under the contract, changed conditions are disclosed equitable adjustments of construction time and pay may be made. When and how this adjustment is held justified and what action the contractor should take are considerered in this article.

First however it should be understood that while it is only of recent years that this article on "changed conditions" has appeared in government contracts, the principle of justice embodied in it is as old as the law of contract. Where conditions turn out in any contract to be materially different from what was contemplated by either party there is said to be no meeting of the minds of the parties, and the courts for many decades, if not centuries, have said that the contract fails for want of a meeting of the minds; in other words, there is nothing on which the contract can operate.

In such cases where the parties choose to go ahead and have the work done on something materially different or to have some different kind of work done, the books say there is a substituted contract. Such contracts may be expressed by language of the parties fixing their new obligations under the changed conditions. If they do not express them in a formal writing, the person for whom the work is done is obliged to pay for the work simply because he has requested it and the other contracting party has done it; and such request by one party and the performance by the other of work requiring time, skill and outlay always creates an agreement to pay for what is done, even though the parties may not have been very formal in expressing their intent to make a contract.

CHANGED CONDITIONS

Should the contractor encounter, or the Government discover during the progress of the work, subsurface and (or) latent conditions at the site materially differing from those indicated in the specifications, the attention of the contracting officer shall be called immediately to such conditions before they are disturbed. The contracting officer shall thereupon promptly investigate the conditions, and if he finds that they materially differ from those shown on the drawings or indicated in the specifications, he shall at once, with the written approval of the head of the department, or his representative, make such changes in the drawings and (or) specifications as he may find necessary, and any increase or decrease of cost and (or) difference in time resulting from such changes shall be adjusted as provided in article 3 of this contract.

(Article 3 provides that in case of increase or decrease of the amount due, or a change in the time required for performance "an equitable adjustment shall be made.")

Reasons for this provision

The law provides that all contracts shall be awarded after public advertisement. The drawings and specifications for large engineering or architectural structures must be seen by an intending contractor before making his proposal to do the work. They are always exhibited to the contractor and copies generally may be taken out on payment of a moderate fee to be refunded when they are returned to the office from which they came. Where it is an engineering work of any importance the drawings and specifications always purport to show what has been discovered by the officers of the government about the conditions expected to be encountered in the performance of the work.

The work often goes to a great depth in the soil. In this case and where the construction is largely under water, as in the cases of locks, dams, bridges and other works of waterways engineering, the work of exploration is difficult and expensive. Borings are quite often made. The results of these borings and other explorations are of the greatest importance as showing the conditions that the contractor may expect to encounter in the work of excavation, pile driving and other construction. Sometimes the investigations are complete. Sometimes economy of time and money leads the officers of the government making these investigations to make them quite inadequately to show the actual conditions. Borings and other investigations may show conditions at one part of the work, but conditions at some other part may turn out to be quite different from those existing at the place explored.

Seldom are representations made in the drawings and specifications intentionally erroneous and deceptive. A few such cases have arisen. In such cases the government is held fully responsible for increased cost occasioned the contractor by being misled by false borings. Such are extreme cases not often met with in engineering. exploraions. Far more common are those cases in which statements as to the character of the soil or other natural conditions are made by government officers from the best information available to them, but where they turn out to be materially different from what was supposed.

It is not always easy to draw the line between such a slight difference as constitutes an allowable deviation from the description given and such a material difference as to constitute the "changed conditions" covered by the article quoted. What constitutes a "changed condition" is not always easy to define. Wherever the work to be done under the changed conditions encountered is substantially more expensive of performance, consumes appreciably greater time, or requires different engineering methods for handling over what the work would have cost or what would have been required if conditions had been as represented, it seems safe to say that there is a changed condition from what is shown on the drawings or indicated in the specifications.

All contracts with the government are made on standard forms prepared by officers of the departments concerned. Contracts are always to have the construction placed upon them which is shown by their language when fairly read in its natural sense. Where the contract is prepared by one party the language in case of any doubt of its meaning is always to have a *construction placed upon it least favorable to the one preparing it and most favorable to the opposite party.*

Natural conditions

Specifications for engineering works generally contain a description of the natural conditions prevailing at the site of the work. These statements are often guarded by language purporting to convey the idea that the government, or other owner of the work to be contracted for, does not warrant the accuracy of the description, and that it is given only for the information of bidders who are expected to make their own investigations. Carefully guarded though these descriptions are, they are always considered to state the most that is known about the situation of the work and the conditions under which it is to be performed.

Where statements are known to be false and to misdescribe natural formations the party making the misrepresentation is always held liable in damages. Where the statements are made to the best knowledge of the officers preparing the specifications, there is no responsibility for slight and immaterial variations in the conditions actually found to prevail at the site of the work. If, however, there is a material difference in the conditions found from the description given by the officers of the government, the contractor is entitled to an equitable adjustment for the conditions thus changed from those which were described in the specifications.

Tunnel construction

In a recent case of a contract made by a railroad for the construction of a tunnel the specifications tendered by the railroad to the intending contractors contained a statement that part of the tunnel at each end is expected to be in earth formation, and the remainder in solid rock, with possibly a short distance in loose rock, or a combination of all three. The court deciding the case said that although the railroad had no conclusive knowledge of the formation when it let the contract, the statement as to the proportions of earth, solid rock, and loose rock in the formation amounted to a representation or assurance on the part of the railroad company, upon which the contractors had a right to rely. The specifications were prepared by the railroad company, and under the rule stated above any ambiguities were to be resolved against the railroad.

In form the language was not a positive declaration of fact. Some meaning must have been intended. The effect of this statement was to influence bidders and affect the terms on which they were willing to do the work. What influence could it have on a rational bidder proposing to do the work other than to be taken by him as a definite assurance with respect to the character of the formation? It was equivalent to saying to prospective bidders:

"In submitting your bids and in contracting for the work you have the right to expect that part of the tunnel excavation will be in earth formation, and the remainder in solid rock, with possibly a short distance in loose rock, or a combination of all three. If you look at the accompanying drawings you will see that the design is suited to that kind of formation and no other."

Thus the statement constituted a warranty. A warranty is in law any definite statement or affirmation made by either party to a contract which could reasonably be supposed to have been intended to induce the other party to enter into the contract, and upon which the party to whom the statement is made relies.

In a recent case it appeared that subsurface and latent conditions materially differing from those shown on the drawings or in the specifications were found, consisting of ledge rock, commercially impossible of removal at the contract price for rock excavation. The contracting officer in a spirit of great equity increased the price for rock excavation, acting in accordance with the changed conditions provision of the contract. Some preliminary work of exploration had been done under which partial payments had been made for rock excavation at the lower rate of the original contract.

Objection was made to the validity of the change order providing for increased price for rock excavation in view of the changed conditions, and especially the payment at the increased price for rock already removed and paid for at the lower price of the original contract. These objections were overruled and payment allowed at the increased price of the change order, both for the rock excavated after the date of the change order and for that already removed and partially paid for.

Dredged materials

In another contract the material to be dredged was described in the specifications as believed to be sand, clay, gravel and boulders, with a warning that the description was not warranted by the United States. The contractor after commencing work discovered that a large part of the material to be dredged was wholly different from the material described—that it was hardpan, consisting of a hard, compact clay in which were embedded stones and small boulders. About 500,000 cu. yd. were to be dredged. Of this vast quantity only about two-thirds corresponded to the description of sand, clay, gravel and boulders, the remaining one-third being hardpan.

Whether the misdescription was known to be false by the government agents or merely constituted a gross and inexcusable error, the contractor was, in either case, entitled to be paid to the extent of what it cost him to remove the hardpan over and above what it would have cost to remove the material described in the specifications. This decision also decided two additional points, one of which (authority of the engineer) will be treated later. The contractor was not to be charged with liquidated damages for the delay in the time of completion. If, in order to get paid on his vouchers for partial payments, he had to certify that the materials encountered were sand, clay, gravel and boulders—and payment would have been refused had he failed so to sertify—there is coercion placed upon him. Such a statement, so certified by the contractors to be true, did not constitute any bar to the recovery of the extra cost.

RULES FOR ASSERTING CLAIMS

The following rules may be laid down as a safe guide, subject to variation in accordance with the circumstances of each particular case:

1. When changed conditions appear the attention of the contracting officer should at once be called to them in accordance with the provision of the contract, and a written request made for a readjustment in time of performance, contract price, or otherwise as provided in the contract.

2. If the request is refused, appeal should be taken to the head of the department or independent establishment involved and the facts fully laid before that officer.

3. In the meantime the work should be promptly proceeded with as provided by the contract.

4. If the request for a readjustment is finally refused the work should, save in extreme cases, nevertheless be proceeded with as ordered, with a reservation of all rights by protest where it is possible to make one.

5. When the work is completed an attempt should be made to place in any final release requested of the contractor a reservation of any specific claims arising out of changed conditions of the work.

6. If permission to place any such reservation in the release is refused, the contractor will then have to decide under the advise of counsel whether to stand on his rights and refuse to receive the payment so tendered him, or whether to accede to the demands of the Government officers and sign an unqualified release.

Driving piles

Where a contract provided for unit price for driving piles into solid rock, and rock bearings many feet lower than the elevations indicated on the plans were found, and the rock was overlaid by a thick bed of unusually stiff hardpan, to penetrate which required the use of methods more expensive than ordinarily employed to driving steel piling, the government engineer approved the payment of a higher price for the additional footage and extra piles, the conditions being changed from such as were anticipated, the contractor was entitled to the additional price owing to the changed conditions encountered.

Where a contract is made for a levee to be constructed on dry ground and the location was changed to a place 2,600 ft. distant where the character of the ground was wet and the earth placed in the embankment retained the moisture and the cost of construction was increased nearly double, such a radical change entitled the contractor to recover the entire increased cost of construction. Where they agreed to it on condition that a ditch be constructed to drain the ground and the owner of the work failed to construct such a ditch, they are entitled to damages for a violation of that agreement. Where the officer authorized to supervise the construction of the work required it to be done in the manner named no question can be raised by the owner as to his authority to order it so to be done.

In excavating for the foundation of a building constituting an extension to the Government Printing Office in Washington, D. C., subsoil conditions were found to be quite different from those shown on the drawings of the contract. The depths shown on those drawings for excavation for the footings were found to be insufficient. The excavation had to go deeper. The contractor was directed to make a test pit and make core borings in that pit. He was required to extend the excavation for the footings to much greater depths, all at a vastly increased cost, and with some delay. The contractor was held to be entitled to be paid the extra cost directly attributable to the unknown and unforeseen conditions encountered in excavating for and constructing the foundation for the building. The refusal of the officers of the government, in charge of construction, to make an allowance for such extra costs was held too arbitrary to be sustained.

Changing methods of construction

Quite often the drawings and specifications of a contract either require construction to be performed by a specified method, or, if the method is not distinctly named, are so drawn as to show to any intelligent engineer the method which he would have to employ in doing the work.

A striking instance of such a case occurred recently with respect to the contract of a county for a sewer. The work involved a tunnel, 8500 ft. in length. The plans disclosed to any intelligent engineer or contractor alignment holes to be drilled from the surface of the ground to the tunnel for the purpose of checking direction. Such holes are used in free-air tunnels but never in tunnel construction by the more complicated and expensive method of compressed air, as they provide an opening through which pressure would be lost. Similar indications that the tunnel was substantially a free-air job were to be drawn from the specifications requiring ventilation, concreting and care of water, methods suitable for a free-air job and impossible for use in a compressed-air job. The requirement to use these free-air methods was a representation that the job was free-air tunnel construction work and amounted to a warranty that the tunnel was substantially a free-air job.

The drawings and specifications were such as to show that only about 600 ft. would have to be constructed by the use of compressed air, but in point of fact there was ten times that quantity, amounting to 6,000 ft. If there had been only a slight and unimportant deviation from the distance of 600 ft. for the use of compressed air, there would have been some reason for holding the contractor to the prices specified in the contract. When, instead of about one-twelfth of the tunnel having to be constructed by compressed-air methods, three-fourths of it had to be so constructed, at a loss to the contractor of fully half a million dollars, the court justly concluded that the contractor had been misled into being required to do an enormous amount of work for which he never bargained. The conditions were so radically changed—the difference amounting to a total change of conditions—that there was an implied contract to pay the value of the work constructed under these changed conditions, by far more difficult methods.

Change in materials

In a recent case the contract contained a provision that changed conditions should entitle the contractor to a change in price. The concrete was divided into classes with a different price for each class. A certain part of the work, owing to natural conditions, was found to require a different kind of concrete from any of the concrete that was specified in the plans and specifications. When this different and more expensive concrete was required, it was classified by the government engineer under one of the classes listed in the specifications and drawings. The difference in the price of the concrete was generally not so much in the composition of the concrete itself as in requiring special form-work to hold it. The classification made by the engineer was held to be arbitrary and erroneous and the contractor was held entitled to be paid for it as under a proper classification differing from any of the classes named in the contract.

Difference in quantities

A contract for engineering construction, whether made for a lump sum or on the basis of unit prices for the materials entering into the work, generally contains a statement of the quantities of the various materials used, or a statement of the dimensions of the structure to be constructed, whether an earth embankment or levee, or a work of stone, concrete or other material. Quite generally the specifications leave some latitude for an unexpected variation in the quantities or dimensions. Seldom can they be stated with absolute exactness. Slight variations either give rise to no claim at all, or to only a slight difference in the quantity to be paid for at the unit price. Where the variation is so gross and extraordinary as to change the contractor's whole work, often converting a paying contract into one of no profit or frequently into one involving great loss, the conditions are said to be so changed that an altogether different work appears as the result. In such cases, either the provision for "changed conditions" applies, or the government or other owner of the work is held to have made a new contract to pay for the totally different work at a greatly enhanced price.

A contract was made by a drainage district for the construction of drains in accordance with specifications, stating the quantity of construction to be done on the basis of a unit price, with a provision permitting the engineer of the district to increase or diminish the quantities to any extent. This was held to mean within ordinary and reasonable limits, not as authorizing the district to eliminate more than half of the work contracted for. The contractor makes his preparations with a view to the performance of the contract on the basis of the quantities stated. If the quantities are cut in two, it means that all of the general preparations for the whole work have to be done at practically the same cost and yet the contractor gets paid for only one-half of the quantity. It was said that municipal corporations should not be permitted to disregard the safeguards thrown around the making of contracts by increasing or reducing the quantity of work to any extent they see fit.

A contract was made involving the use of stone masonry to an inconsiderable extent. A great increase in the quantity was subsequently called for in the work of actual construction. It had to be placed in a different and far more expensive manner, and yet the city government which made the contract attempted to get it from the contractor for the same unit price that it originally undertook to pay for a much less quantity of stone called for by the specifications, placed in a much simpler manner. No such work as that actually performed was in the minds of the parties when they made the original contract, nor could they have intended to authorize so radical an alteration as to require it. Since they did not contemplate or intend to contract concerning it when they made their agreement, it was new and different work from that covered by their contract, and the contractors were entitled to recover its reasonable value. The court held that the city had no right to require the contractors to perform a larger quantity of work, radically different in character, nature and cost from that originally contemplated by the parties when they made their contract. The decision of the engineer to the contrary, even though his decision was by the contract made final and conclusive upon both parties, was held ineffectual to deprive the contractors of the right to the reasonable value of this totally different work.

Authority of the engineer

All construction contracts make the decision of the engineer conclusive on questions of fact arising during the performance of the contract. This judgment, when exercised in good faith and equity, is generally regarded by the courts as controlling. Quite often when the engineer in charge orders the work done in a different manner from that provided by the specifications so as to create a changed condition, it is the government, or other owner of the work, who raises the question of his authority to order the contractor to do the work in a different manner, on the ground that the engineer has no authority to make a new contract.

In a railroad case, arising fifty years ago, where the specifications provided for a drainage ditch largely above ground and requiring trestles and embankment work of comparative simplicity, there was a change made requiring a continuous ditch constituting what was described as a "new system." It was emphatically a case of changed conditions. The engineer's authority extended to directing the contractors in what manner they were to do the work. The claim of the contractors that the change constituted a completely different contract from the one originally entered into was met by the question of the power of the engineer to have the system so completely changed involving the company in greatly enhanced expense. It was held by the highest court that as long as the engineer had authority to direct the manner in which the work was to be carried out, and as he required the contractors to carry it out in that manner, the owners were bound to pay for the increased work necessitated by the exercise of his authority. The company was held bound to pay for the work that he had ordered.

It has indeed been held by courts of good authority that this provision as to the mode in which work shall be ordered or even a totally changed condition provided for may be waived by the parties interested, and that it is not in all cases necessary to show that complete formal requirements of the contract have been complied with where the work has been done in accordance with the directions of the engineer authorized to supervise the construction.

Final release—duress

Some forms of contract provide that when the work is completed and accepted, final payment shall be made on the contractor giving to the government, or other owner of the work contracted for, a final release. The object is to clean up all claims of every character arising out of the work at the time of final payment under the contract.

Where the contractor gives a final release of this character, he is generally held to be held bound by it.

It often occurs that there are unsettled claims arising out of changed conditions or otherwise. In such cases the contracting officer in a spirit of fairness sometimes allows the contractor to reserve the right to proceed in the courts to get compensation for the additional amount due notwithstanding the final release.

In aggravated cases not even a release final in form will be allowed to stand in the way of the courts awarding what is justly due the contractor.

In one instance officers of the government threatened that unless settlement were made on terms proposed by them for goods which the government had contracted to take they would not even pay for goods already purchased under contract and accepted. Such a course of action had not even a shadow of a legal right and a settlement contract based thereon for the purpose of avoiding impending financial ruin was held to be void and the contractor not to be bound by the terms thereof.

In another case the terms of the contract provided for payment upon the execution of a release. The contract for repairs and alterations to be made to vessels was cancelled and terminated by the department with admitted bills amounting to $850,000, which were held up for a year and a half without explanation, and then paid only on the exaction of a final release. The whole transaction was held to be so tainted with duress as to invalidate the release and entitle the contractor to another quarter of a million dollars held by the court to be plainly due.

Sometimes, indeed, where a release is given, its terms, even though general, are held not to extend to the particular transaction in controversy. In a series of torpedo manufacturing contracts, the Secretary of the Navy promised, in order to avert a strike of laborers supposed to be threatened, to reimburse the contractor if he would increase the wages of the laborers. He did so to a very large degree, involving three-quarters of a million dollars. On the completion of each contract he gave a full and final release of all claims under it. These releases were held to constitute no bar to his claim for the increased wages paid the laborers on the faith of the promise of the Secretary of the Navy.

In each case the terms of the release and the circumstances surrounding its execution must be looked to before it can be stated with certainty whether it constitutes a bar to the assertion of a claim for items justly remaining due under contract.

Water Power in the Northwest

(Special Correspondence)

WHAT PROGRESS is being made toward marketing power from the Bonneville plant, the first of the federal power "yardsticks"? This query is natural at this time because the first two generating units in that much publicized plant have been ready for operation for some time. A thumb-nail sketch of progress and prospects in publicly owned water power developments in the Pacific Northwest follows:

The first two Bonneville units which have a combined output of 90,400 kw. were ready to carry load this past summer. Two additional units (104,000 kw. combined) are now in course of installation; more will be added from time to time until the ultimate capacity of 504,000 kw. is reached.

The power is offered for sale on a uniform rate basis: $14.50 per kilowatt-year for primary power and $9.50 for secondary power at the dam site or $17.50 primary and $11.50 secondary delivered at any point on the several hundred miles of transmission system on which construction work has already begun. The government will not go into the retail business: minimum sales at the dam will be in 2,500-kw. blocks and on the transmission network sales will be only through some agency established for retailing.

The transmission line network, at present planned to comprise about 565 mi., is estimated to cost about $20,000,000, of which allotment of the first $5,000,000 of federal funds has been obtained; construction is in progress under the direction of J. D. Ross, federal power administrator. One main transmission line will lead from Bonneville down the north side of the river to Vancouver, Wash., thence south to Portland, Eugene and Salem and west to Kelso, Aberdeen, Hoquiam and Centralia. A second trunk will go upstream from Bonneville as far as The Dalles, Ore., and thence north to Grand Coulee. On this projected network contracts had been signed by Sept. 1 for only 5,100 kw.

At Grand Coulee Dam the initial installation, in three units, will be 315,000 kw., from which a considerable block will be required for the proposed pumping of water from the reservoir into the gorge whence there will be gravity flow to the 1,200,000 acres to be irrigated on the Columbia basin project. Ultimately 1,650,000 kw. is to be installed at Grand Coulee. The first of the Grand Coulee power to be sold to the public is expected to be available within three years.

On the Skagit River construction is now under way on Ruby Dam which is expected, within two years, to increase storage for Seattle's Skagit River plants enough to make full capacity of units now installed available continuously. It is expected that market for this municipally owned power will be sought in conjunction with sale of power from Bonneville and Grand Coulee.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Curve Superelevation Maintenance

JOHN C. PARK
University of Arizona, Tucson

In these days of high speeds, most designing engineers are convinced of the necessity of designing highways for the highest speeds that the type of country and available funds will permit. Safety will not be served, however, unless the designed superelevation is carefully built into the curves and maintained there.

Ordinary care in constructing a superelevated curve will not suffice. Exceptional care must be exercised so that the superelevation will endure. A little settlement on the tangent may be of no consequence, but the same settlement on the outside of a curve designed for a certain speed, and so marked, may cause loss of life. The job begins with the subgrade. Blade grader men find it difficult to shift from the crowned section of the tangent onto the straight section of the curve. If the subgrade does not have the proper superelevation, the pavement is likely to be lacking also. In addition to actually putting the proper superelevation into the subgrade, it is important that the condition of the subgrade be such that settlement is unlikely, particularly on the outside of the curve. These remarks apply particularly to the flexible type of pavement.

Assuming the proper superelevation has been built into the curve, it should then be checked periodically to see if it is being maintained. Many maintenance men have not yet sensed the need for this sort of checking and will find it hard to disturb a piece of pavement which is in perfect condition except for the fact that it has lost considerable superelevation. Considerations of safety, however, demand that this be done.

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An Adjustable Abutment

The new Webber Creek Bridge on the highway between Sacramento and Lake Tahoe, one of the famous old gold rush routes, illustrates California practice of using "adjustable abutments." Consisting of a simple spread footing slab, these abutments are used in conjunction with continuous girder bridges and support one end of a simple end-span girder, the other end being hinged to a cantilever overhang of the continuous girder portion. Abutment settlement, if any, is adjusted by jacking up the end of the simple span girder, the opposite end rotating about the hinge in the span.

Pleasing appearance was sought in the Webber Creek Bridge through careful proportioning and simplicity of detail rather than through ornamentation. The bridge, of concrete rigid frame type, is over 100 ft. high and is 322 ft. long. The roadway is 26 ft. wide. The Campbell Construction Co. built it at a cost of $39,000 under the supervision of F. W. Panhorst, bridge engineer, Division of Highways, Sacramento, Calif.

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Two Pumps For High Pressure

K. B. HUMPHREY
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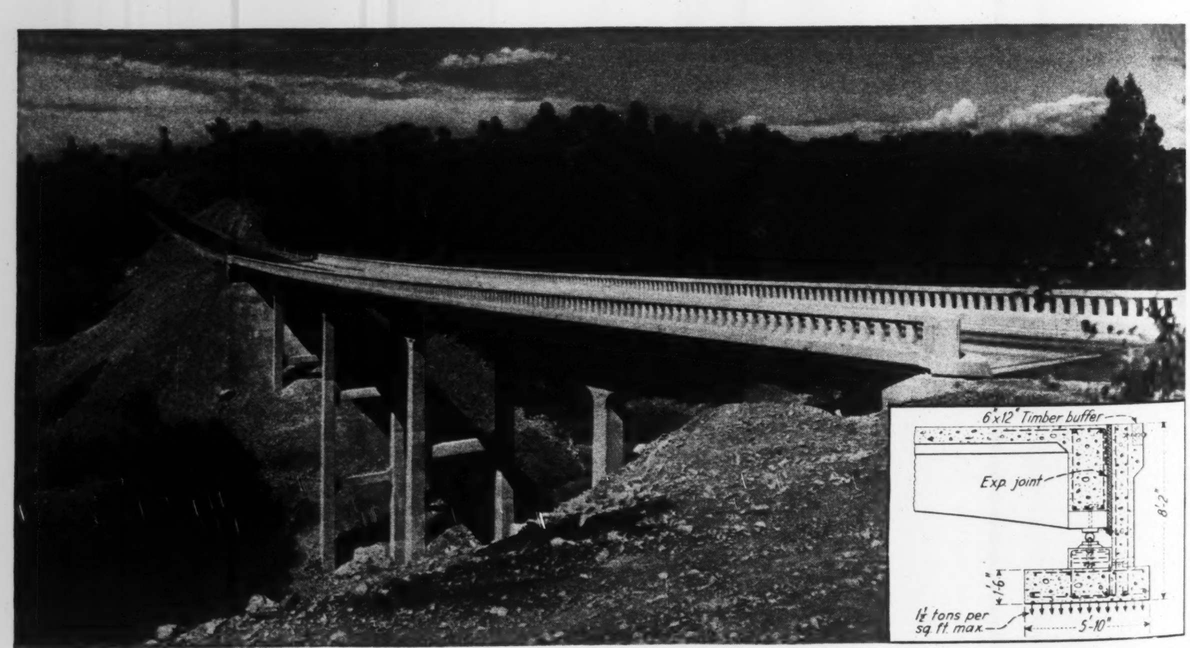
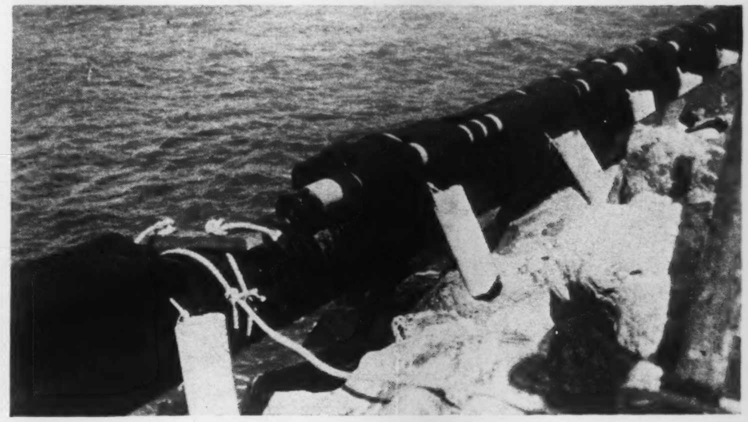
In many cases it is necessary, or at least very convenient for the contractor to have a source of high pressure water. On most jobs at least two centrifugal pumps are available. They may not be of the same size or designed to give the same pressure; yet they may be used together by connecting the suction of the second pump to the discharge of the first.



Webber Creek Bridge in California and a detail of the simple abutments used.



CAMERA MEMORANDA

1. Outfall sewer extending 1,000 ft. outshore from Treasure Island, the site of the San Francisco world's fair, being towed into position for sinking.

2. While being towed into position the 18-in. corrugated pipe was floated by wax-paper tubes held to the pipe by paper wrapping. A ripcord along the pipe under the wrapping tore the wrapping loose when pulled and loosened the flotation tubes and the pipe was sunk to the bottom by the attached pairs of concrete weights.

In most cases it is desirable to use the larger pump for the first stage to insure that it will remain full of water when operating. The smaller pump acts somewhat as a throttle as far as capacity is concerned, and it is better to throttle the discharge than the suction.

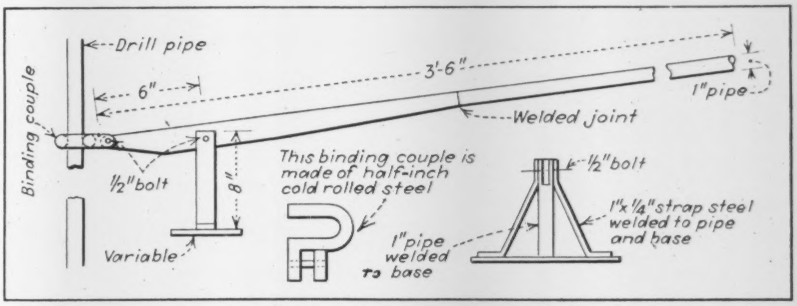
The reason why centrifugal pumps can be connected in series is because the discharge at any given speed is dependent upon the head being pumped against. In other words the pressure which can be obtained is dependent upon the amount of water flowing and it is practicable to cut down the flow by throttling the discharge and raising the pressure. If one pump is allowed to pump into the suction of a second pump, the amount of water which will flow will depend upon the size and other characteristics of the pumps. If, under operating conditions the first pump develops a pressure of 50 lb. per sq.in. at a certain discharge, and the second pump will develop a pressure of 100 lb. per sq.in. at the same discharge, the two hooked in series will produce nearly the sum of the two pressures, say 150 lb. Actually the pressure would be slightly higher due to the fact that the second pump would not have to take care of any loss due to the suction. In starting two pumps in series it is only necessary to prime the first pump. Due to the characteristics of the centrifugal pump each will take its proper share of the load.

Paint Saves Handrail

Where deterioration has occurred in concrete handrails on some of the highway bridges of the Oregon state highway system, experiment is being made with a waterproofing treatment covered with an oil paint. Although final results will not be known until after several seasons of exposure, appearance already has been greatly improved and indications are that progressive deterioration has been arrested.

The deterioration starts with the formation of hair-line checks and small cracks which, through the action of freezing and thawing, develop into raveling and surface disintegration. The deterioration is undoubtedly caused by freezing and thawing, but whether the initial checking which allows the entrance of water is chargeable to insufficient curing of concrete made with fast setting cement, to undetected unsoundness in the cement or to unsound aggregates has not been definitely established. The hand rails affected are from 6 to 20 years old and in localities where many cycles of freezing and thawing occur.

The waterproofing treatment consists of a first coat of half turpentine and half raw linseed oil, brushed on hot, followed by repeated coats of hot, raw linseed oil until the concrete is saturated. A final coat of grey lead and oil paint is applied to give a satisfactory appearance. On jobs up to one year old no peeling or other paint failure has been observed nor has any further disintegration of the concrete occurred.


Drill pipe
Binding couple
6"
3'-6"
1" pipe
Welded joint
½" bolt
8"
Variable
This binding couple is made of half-inch cold rolled steel
1" pipe welded to base
½" bolt
1"x ¼" strap steel welded to pipe and base

LEVER FOR PULLING SOIL AUGER

This lever is being used to advantage in pulling soil sampling augers by the Illinois Division of Highways soils department engineers of District No. 4, Peoria, Ill. It was devised by S. Fred Long, of Peoria.

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

CLOSED FILTERS—Conflicting evidence has been produced concerning the effect of ventilating trickling filters. Statements have been made that the increased oxygen supply with forced ventilation is mainly responsible for higher purification; others have maintained that the carbon-dioxide concentration within the bed becomes so high that activities are impaired. Hamlin and Wilson (*The Surveyor* July 8, 1938) conclude from studies on full size open and closed filters that increased output is of greater influence than artificial ventilation of a closed filter. Heat conservation in a closed filter is of real importance—air introduced during warm weather did not materially assist in the purification. Small scale experiments where the atmosphere in the voids of the bed was replaced about 6.4 times a day with carbon dioxide, showed that the presence of carbon dioxide within a filter was not injurious, and that the necessity for proper and adequate ventilation of a filter had no relationship with the removal of carbon dioxide. It appears therefore that closed filters will perform better and more uniformly in winter than will open filters under the same conditions.

PARTIAL ACTIVATION—During the last several years the tendency has been to reduce the amount of air to a minimum in activated sludge plants. This has resulted in good clarification and stabilized effluents, but no nitrification. The chief disadvantages of the "complete" biological process are longer detention periods and greater air consumption. Lockett (*Proc.* Inst. Sew. Pur. Part II, p. 88, 1937) discussing the operation of the Mogden (London) plant lists advantages of the "complete" process as compared with the "partial" process in which non-nitrified effluents are produced. These are: a comparatively dense sludge; freedom from bulking; large reduction of surplus sludge; almost complete freedom from odors (even when septic sewage is received); an effluent relatively much superior for the preservation of good stream conditions; greater capacity for overcoming overloads; and finally, a sludge more amenable to dewatering and less liable to cause nuisances when disposed of on land. When sewages contain high proportions of inhibitory trade wastes the disadvantages of longer detention and greater air consumption may be considerable, but when nitrification is established sudden "shots" of wastes can be dealt with. With weak sewages there is much less need of the "complete" process.

PLANT HORMONES—The use of certain chemical stimulants (harmones, for instance) to promote plant growth, is not new, and in the past few years scientists have been successfully using these substances for getting roots started faster and more vigorously. Experiments have been extended this year to large field trials of grain production in various parts of Canada. Instead of putting the artificial hormones in water and applying them in that way they have been distributed in dust. It is of interest to note that growth-promoting substances such as indole and skatole, which stimulate rooting and other growth phenomena of plants, are present in sewage and sludge (*Sewage Works Journal* 10, 643 and 653, 1938).

On the basis of the amounts of these substances present, raw sewage would have the greatest value, followed by settled and chemically-treated sewage, with oxidized effluents the least. Indole and skatole increase during anaerobic digestion but they are utilized by methane organisms in gas production, so that ripe sludge contains less than fresh solids. Addition of dewatering chemicals fixes these substances, high heat destroys them, but drying at ordinary temperature has little effect. Digested sludge dried at low temperature contains relatively large amounts of them and would have value as a base for complete fertilizer aside from the amounts of nitrogen, potash and phosphorous present in the sludge.

SHORT TIME DIGESTION—Digestion of mixtures of fresh solids and activated sludge are considered more troublesome and require longer time than the digestion of fresh solids alone. Based upon the results obtained from a demonstration plant, Manchester, England has built a large-scale plant where the average digestion time varied from 10.7 to 11.7 days. Ardern, Jepson and Klein (*The Surveyor* July 8, 1938) had stored a quantity of settled sludge to be used as seed for some months before the construction of the plant was completed. They were able to collect gas after 12 days and within 30 days had sufficient gas available to dispense with the auxiliary boiler for heating of the tanks. Starting with seed sludge having pH values of 6.7 to 6.9 the ripe sludge quickly reached values of 7.4 to 7.5 and only slight foaming trouble was experienced in the early stages. Activated sludge was added with fresh solids in a proportion of 15 to 20 per cent.

Sedimentation of the supernatant liquor in secondary tanks before disposal, produced a satisfactory quality of decanted water. Some difficulty was experienced later in obtaining a clear separation of water and sludge, possibly due to withdrawing imperfectly digested sludge from the primary digestors. This was overcome by stopping the overflow of primary digestors to secondary tanks when filling by continued withdrawal of sludge from the bottom of the tanks and by working the secondary digestors in parallel instead of in series.

KILLS HOOKWORM—At the Singapore plant, before sludge is passed to the drying bed, the digested material is heated to a minimum temperature of 150 deg. F. and maintained at that temperature for at least 30 minutes in order to kill the hookworm parasites. According to the annual report of K. G. M. Fraser, municipal engineer, some 5,650,000 gal. of sludge, with a moisture content of about 95.7 per cent, were treated in this manner.